VOL. 6 NO. 22
November 30, 1981

# Energy Research Abstracts

ABSTRACTS 32803-34203

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

# CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications which are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the energy data base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below.

## PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

*Energy Abstracts for Policy Analysis (EAPA)*

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following: programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $4.00, foreign $5.00 per copy; annual cumulative index, domestic $6.00, foreign $7.50 per copy. The annual subscription price is $44.00 for domestic subscribers and $55.00 for foreign subscribers.

*Energy Research Abstracts (ERA)*

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. Indexes are cumulated semiannually and annually. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues including a semiannual index and an annual index is $184.00 for domestic subscribers and $230.00 for foreign subscribers. The semiannual and annual indexes will also be available separately to subscribers. The cost for the semiannual index is $18.00 (domestic) or $22.50 (foreign); the annual index is $33.00 (domestic) or $41.25 (foreign). A single issue costs $5.55 (domestic) or $6.95 (foreign).

The following publications are available to the public on a subscription basis from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $45.00 for domestic subscribers and $90.00 for subscribers outside the North American Continent. A single issue is $6.00 (domestic) and $12.00 (outside the North American Continent).

*Current Energy Patents (CEP)*

A monthly publication providing abstracting and indexing coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization. Available as PB81-902800.

*Energy Conservation Update (ECU)*

A monthly abstract journal devoted to current information on energy conservation in buildings, transportation and propulsion, and industry; waste processing plants and equipment; energy storage; energy conversion; advanced automotive systems; combustion systems; power cycles; synthetic fuels; and power transmission. Available as PB81-914800.

*Energy and the Environment (EAE)*

A monthly abstract journal devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment. Available as PB81-914900.

*Fossil Energy Update (FEU)*

A monthly abstract journal devoted to information on the processing and use of fossil fuels. Available as PB81-914600.

*Fusion Energy Update (CFU)*

A monthly abstract journal devoted to information on controlled thermonuclear research. Available as PB81-915300.

*Geothermal Energy Update (GEU)*

A monthly abstract journal devoted to information on the exploration and development of geothermal resources. Available as PB81-914700.

*Solar Energy Update (SEU)*

A monthly abstract journal devoted to information on the utilization of solar, tidal, and wind energy. Available as PB81-914500.

*Synthetic Fuels Update (SFU)*

A monthly abstract journal devoted to information on coal gasification; coal liquefaction; other coal processing; biomass conversion to fuel; shale oil and tar sand bitumen production; hydrogen fuels; other hydrocarbon fuels; alcohol fuels; and inorganic hydrogen compound fuels. Available as PB81-902700.

## INTERNATIONAL ENERGY PUBLICATIONS

*Atomindex* (Published in cooperation with the Technical Information Center by the International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria)

A semimonthly abstract journal devoted to information on nuclear science and technology. Through an exchange agreement, IAEA/INIS provides all non-U. S. nuclear information of *Atomindex* to TIC for inclusion in the DOE/RECON Data Base; in turn, TIC provides all U. S. nuclear information to IAEA/INIS for inclusion in *Atomindex*. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

*Coal Abstracts* (Published in cooperation with the Technical Information Center by the International Energy Agency, IEA Coal Research, London, England)

A monthly abstract journal devoted to information on coal. Through an exchange agreement, IEA Coal Research provides all non-U. S. coal information of *Coal Abstracts* to TIC for inclusion in the DOE/RECON Data Base; in turn, TIC provides all U. S. coal information to IEA Coal Research for inclusion in *Coal Abstracts*. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

International Copyright, © U. S. Department of Energy, 1979, under the provisions of the Universal Copyright Convention.
United States copyright is not asserted under the United States Copyright Law, Title 17, United States Code.

## Editor's Note

Printed cumulative indexes will be prepared for *Energy Research Abstracts (ERA)*, Volume 6 for 1981. The Volume 7, 1982 subscription will provide the 24 semi-monthly issues only. No printed cumulative indexes will be prepared for *ERA*, Volume 7, 1982. For those not making use of one or more of the on-line systems, TIC expects to make available a microfiche version of *ERA* annual indexes for Volume 7. Sources and prices for these microfiche will be announced at a later date.

With Volume 7, the coverage of *Energy Research Abstracts* will be broadened to announce all unclassified, publicly available reports processed by the Technical Information Center. This coverage increase will result in the inclusion of 10,000 additional abstracts. Discontinuance of the cumulative indexes will offset the cost of this additional coverage.

The total content of *ERA* is maintained on a continuing basis in the Energy Data Base (EDB). EDB is available for searching via the DOE/RECON on-line system and is also available commercially via Bibliographic Retrieval Service (BRS). Commercial availability via Dialog and Orbit will be added in the fall. This widespread availability of constantly cumulating indexes to *ERA* information decreases the usefulness of printed cumulative indexes to an impractical level.

The editorial staff believes its decision to rely on computerized systems for retrospective searching is both forward thinking and cost-effective. It is expected that any inconvenience to *ERA* users will be minimal.

Dave E. Bost

energinfo ERA

Vol. 6, No. 22
ISSN: 0160-3604
CODEN: ERABD
November 30, 1981

# ENERGY RESEARCH ABSTRACTS

**ABOUT THE TECHNICAL INFORMATION CENTER**

The Technical Information Center, as the national information center for the Department of Energy, manages, publishes, and disseminates scientific, technical, and practical energy information acquired from worldwide sources. It builds and maintains energy information data bases used to prepare abstracting journals, bibliographies, and literature searches. The data bases are also searchable via the Department's on-line retrieval system, DOE/RECON. This information is provided to DOE program offices and contractors; scientists; engineers; educational, commercial, and industrial communities; and the general public. The Technical Information Center conducts an active announcement and marketing program. It establishes policy and administers control of an inventory and registry for DOE publications. The Center also develops and evaluates new and effective information systems and services as required by scientific and technical management within the Department of Energy.

**UNITED STATES DEPARTMENT OF ENERGY**

**James B. Edwards**
Secretary

William S. Heffelfinger
Assistant Secretary
Management and Administration

**Joseph G. Coyne**
Manager
Technical Information Center

## ABOUT *ENERGY RESEARCH ABSTRACTS*

*Energy Research Abstracts (ERA)* provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers, and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

*ERA* is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, conservation, safety, environmental impacts, and regulation.

*ERA* is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Federal, state, and municipal agencies concerned with energy development, conservation, and usage may obtain *ERA* free of charge. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

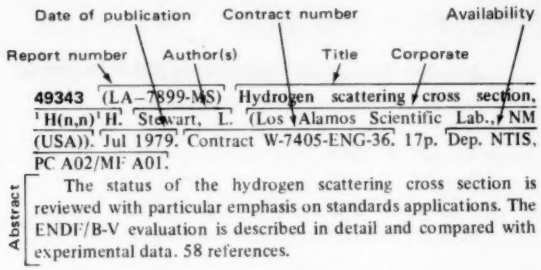
*ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues including a semiannual index and an annual index is $184.00 for domestic subscribers and $230.00 for foreign subscribers. The semiannual and annual indexes are also available separately to subscribers. The cost for the semiannual index is $18.00 (domestic) or $22.50 (foreign); the annual index is $33.00 (domestic) or $41.25 (foreign). A single issue costs $5.55 (domestic) or $6.95 (foreign).

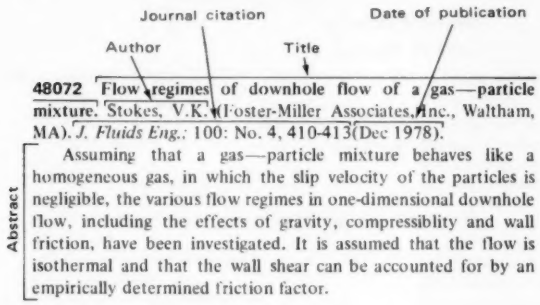
Published by the **United States Department of Energy, Technical Information Center**
**P. O. Box 62, Oak Ridge, Tennessee 37830**

# HOW TO USE *ENERGY RESEARCH ABSTRACTS*

## • ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Date of publication
Contract number
Availability
Report number
Author(s)
Title
Corporate
49343 (LA-7899-MS) Hydrogen scattering cross section, ¹H(n,n)¹H. Stewart, L. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 17p. Dep. NTIS, PC A02/MF A01.
Abstract
The status of the hydrogen scattering cross section is reviewed with particular emphasis on standards applications. The ENDF/B-V evaluation is described in detail and compared with experimental data. 58 references.


Journal citation
Date of publication
Author
Title
48072 Flow regimes of downhole flow of a gas—particle mixture. Stokes, V.K. (Foster-Miller Associates, Inc., Waltham, MA). J. Fluids Eng.: 100: No. 4, 410-413 (Dec 1978).
Abstract
Assuming that a gas—particle mixture behaves like a homogeneous gas, in which the slip velocity of the particles is negligible, the various flow regimes in one-dimensional downhole flow, including the effects of gravity, compressiblity and wall friction, have been investigated. It is assumed that the flow is isothermal and that the wall shear can be accounted for by an empirically determined friction factor.

## • INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. These indexes are cumulated semiannually and annually. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

## • Corporate Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

**49343** (LA-7899-MS) Hydrogen scattering cross section, ¹H(n,n)¹H. Stewart, L. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 17p. Dep. NTIS, PC A02/MF A01.

is indexed as:

**Los Alamos Scientific Lab., NM (USA)**
Advanced laser fusion target fabrication research and development proposal, 4:48249 (LA-7619-P)
Hydrogen scattering cross section, ¹H(n,n)¹H, 4:49343 (LA-7899-MS)

## • Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

**Stewart, L.**, Hydrogen scattering cross section, ¹H(n,n)¹H, 4:49343 (LA-7899-MS)
**Stewart, M.D.**, *See* McInroy, J.F., 4:49280
**Stewart, W.**, *See* Dean, J.W., 4:48543
**Stimson, J.**, Reproduction, growth, and survival of Enewetak corals, 4:49200 (NVO-0703-1, pp 56-59)

## • Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles and informative phrases, or both, specific to these entries are arranged alphabetically under the entries.

**HYDROGEN I TARGET**
**Neutron Reactions**
Hydrogen scattering cross section, ¹H(n,n)¹H (Above 100 keV, review), 4:49343 (LA-7899-MS)
**HYDROGEN NITRATES**
*See NITRIC ACID*
**HYDROLOGY**
**Research Programs**
Inventory of advanced energy technologies and energy conservation research and development: 1976-1978. Volume II. Prepared for the Committee on Science and Technology, U.S. House of Representatives, 96*th* Congress, 4:48749.

## • Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

| | | |
|---|---|---|
| **W-7405-ENG-36** | **Los Alamos Scientific Lab., NM (USA)** | |
| | 3:49698 | LA-tr-78-45 |
| | 3:49857 | LA-7224T |
| | 3:49863 | LA-7235-MS |
| **W-7405-ENG-48** | **California Univ., Livermore (USA). Lawrence Livermore Lab.** | |
| | 3:49386 | UCRL-52456 |
| | 3:49431 | UCRL-52405 |

## • Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience.

| | | |
|---|---|---|
| **LA-7899-MS** | 4:49343 | Dep. NTIS, PC A02/MF A01 |
| **LA-tr-78-69** | 4:48158 | Dep. NTIS, PC A03/MF A01 |

# STAFF OF ENERGY RESEARCH ABSTRACTS

**Editor**
David E. Bost

**Assistant Editors**
Lee M. Thompson
Charles E. Stuber

**Associate Editors for Fossil Energy**
M. Catherine Grissom
D. Lamar Cason
Dorothy M. Chertok
Lynda H. Kern
Betty L. McDowell
Lorne T. Newman
Donna G. Powers
Amy T. Tamura

**Associate Editors for Physical Sciences and Engineering**
Robert C. Kelly
Jack Blanshei
Donato DiGregorio
Lisbeth C. Lieberman
W. Hugh Kinser
George H. Thoeming

**Associate Editors for Environment and Life Sciences**
Sidney F. Lanier
E. Ray Bedford
Polly S. Blackburn
Jane G. Buchanan
Robert J. Chertok
Kathleen R. Meyer
Axel C. Ringe
David L. Snow

**Associate Editors for Nuclear Energy**
Henry D. Raleigh
David C. Cunningham
James R. Dulaney
Lawrence T. Whitehead
Milton O. Whitson

**Associate Editors for Conservation and Solar Energy**
Lila B. Smith
Dona C. Keller
Mona H. Raridon
Jerry M. Thomas
Martha C. Wilson
Larry E. Williams

**Report Evaluator**
John H. Mitchell

**Subject Heading Specialist**
Julia S. Redford

**Corporate Author Specialist**
Patsy L. Hendricks

**Report Number Specialist**
Wanda Parks

**Contract Number Specialist**
William D. Matheny

**Cataloging and Digitizing Coordinator**
J. Paul Meredith

**Computer Processing Coordinator**
Billy H. Brady

**Publishing Coordinator**
Irene D. Keller

International Copyright, © U. S. Department of Energy, 1979, under the provisions of the Universal Copyright Convention. United States copyright is not asserted under the United States Copyright Law, Title 17, United States Code.

Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts*, Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

# SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.


**01 COAL AND COAL PRODUCTS**
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Regulations

**02 PETROLEUM**
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Policy, Legislation, and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

**03 NATURAL GAS**
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Effects
- 09 Artificial Stimulation, Plowshare, etc.
- 10 Policy, Legislation, and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

**04 OIL SHALES AND TAR SANDS**
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

**05 NUCLEAR FUELS**
- 01 Reserves
- 02 Exploration
- 03 Mining
- 04 Feed Processing
- 05 Enrichment
- 06 By-Products
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing and Economics
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Regulations

**06 FUSION FUELS**
- 01 Sources
- 02 Processing
- 03 By-Products
- 04 Transport and Storage
- 05 Health and Safety
- 06 Regulations and Policy
- 07 Waste Management
- 08 Properties
- 09 Environmental Aspects

**07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY**
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies

**08 HYDROGEN**
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

**09 OTHER SYNTHETIC AND NATURAL FUELS**
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

**13 HYDRO ENERGY**
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power Conversion Systems

**14 SOLAR ENERGY**
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Plants
- 07 Solar Thermal Power Plants
- 08 Ocean Thermal Gradient Power Plants
- 09 Solar Radiation Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

**15 GEOTHERMAL ENERGY**
- 01 Resource Status and Assessment
- 02 Geology, Hydrology, and Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects

**15 GEOTHERMAL ENERGY (CONT.)**
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 07 By-Products
- 08 Geothermal Power Plants
- 09 Geothermal Engineering
- 10 Direct Energy Utilization
- 20 Geothermal Data and Theory

**16 TIDAL POWER**
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 07 Tidal Power Plants
- 08 Wave Energy Converters

**17 WIND ENERGY**
- 01 Availability (Climatology)
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 06 Wind Energy Engineering

**20 ELECTRIC POWER ENGINEERING**
- 01 Power Plants and Power Generation
- 02 Environmental Aspects
- 03 Power Transmission and Distribution

**21 NUCLEAR POWER PLANTS**
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 05 Power Reactors, Breeding
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 07 Regulation and Licensing
- 08 Economics
- 09 Process Heat Reactors

**22 NUCLEAR REACTOR TECHNOLOGY**
- 01 Theory and Calculation
- 02 Components and Accessories
- 03 Fuel Elements
- 04 Control Systems
- 05 Environmental Aspects
- 06 Research, Test, and Experimental Reactors
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety

**25 ENERGY STORAGE**
- 01 Magnetic
- 02 Compressed Gas
- 03 Pumped Hydro
- 04 Capacitor Banks
- 05 Flywheels
- 06 Thermal
- 07 Liquefied Gas
- 08 Chemical
- 09 Batteries

**29 ENERGY PLANNING AND POLICY**
- 01 Energy Analysis and Modeling
- 02 Economics and Sociology
- 03 Environment, Health, and Safety
- 04 Natural Resources
- 05 Research, Development, Demonstration, and Commercialization
- 06 Nuclear Energy
- 07 Transport and Storage
- 08 Waste Heat Utilization
- 10 Conservation
- 20 Supply, Demand, and Forecasting
- 30 Policy, Legislation, and Regulation
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 60 Electric Power
- 80 Consumption and Utilization
- 90 Unconventional Sources and Power Generation

**30 ENERGY CONVERSION**
- 01 MHD Generators
- 02 EHD Generators
- 03 Thermoelectric Generators
- 04 Thermionic Converters
- 05 Fuel Cells
- 08 Electromechanical Converters

**32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION**
- 01 Buildings
- 02 Transportation
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 09 Education and Public Relations

**33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS**
- 01 Internal Combustion Engines
- 02 External Combustion Engines
- 03 Electric-Powered Systems
- 04 Hybrid Systems
- 05 Flywheel Propulsion
- 06 Vehicle Design Factors
- 07 Emission Control
- 08 Alternative Fuels

**36 MATERIALS**
- 01 Metals and Alloys
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 04 Polymers and Plastics
- 06 Other Materials

**40 CHEMISTRY**
- 01 Analytical and Separations Chemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 04 Electrochemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry
- 08 Combustion Chemistry

**42 ENGINEERING**
- 01 General Engineering
- 02 Facilities and Equipment
- 03 Lasers
- 04 Heat Transfer and Fluid Flow
- 05 Materials Testing

**42 ENGINEERING (CONT.)**
- 06 Safety Engineering
- 07 Vacuum Engineering
- 08 Electronic Circuits and Devices
- 09 Waste Processing Plants and Equipment
- 10 Combustion Systems
- 20 Underground Engineering
- 30 Marine Engineering
- 40 Pollution Control Equipment
- 50 Power Cycles

**43 PARTICLE ACCELERATORS**
- 01 Design, Development, and Operation
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 03 Auxiliaries and Components
- 04 Storage Rings

**44 INSTRUMENTATION**
- 01 Radiation Instrumentation
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 03 Miscellaneous Instruments
- 04 Well Logging Instrumentation

**45 EXPLOSIONS AND EXPLOSIVES**
- 01 Chemical
- 02 Nuclear
- 03 Explosion Detection

**50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

**51 ENVIRONMENTAL SCIENCES, TERRESTRIAL**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

**52 ENVIRONMENTAL SCIENCES, AQUATIC**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

**53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES**
- 01 Social and Economic Studies
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements

**55 BIOMEDICAL SCIENCES, BASIC STUDIES**
01 Behavioral Biology
02 Biochemistry
03 Cytology
04 Genetics
05 Metabolism
06 Medicine
07 Microbiology
08 Morphology
09 Pathology
10 Physiological Systems
20 Public Health
30 Agriculture and Food Technology

**56 BIOMEDICAL SCIENCES, APPLIED STUDIES**
01 Radiation Effects
02 Thermal Effects
03 Chemicals Metabolism and Toxicity
04 Other Environmental Pollutant Effects

**57 HEALTH AND SAFETY**

**58 GEOSCIENCES**
01 Geology and Hydrology
02 Geophysics
03 Mineralogy, Petrology, and Rock Mechanics
04 Geochemistry
05 Oceanography

**64 PHYSICS RESEARCH**
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

**65 PHYSICS RESEARCH (CONT.)**
10 Nuclear Physics
40 Radiation and Shielding Physics
50 Medical Physics
60 Solid State Physics
70 Theoretical Physics
80 Mathematical Physics

**65 PHYSICS RESEARCH (CONT.)**
90 Communication, Education, History, and Philosophy

**70 FUSION ENERGY**
01 Plasma Research
02 Fusion Power Plant Technology

**99 GENERAL AND MISCELLANEOUS**
01 Management
02 Mathematics and Computers
03 Information Handling
04 Law
05 Civilian Defense

**CORPORATE INDEX**

**AUTHOR INDEX**

**SUBJECT INDEX**

**CONTRACT NUMBER INDEX**

**REPORT NUMBER INDEX**

# SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

**33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS**
- 08 Alternative Fuels
- 03 Electric-Powered Systems
- 07 Emission Control
- 02 External Combustion Engines
- 05 Flywheel Propulsion
- 04 Hybrid Systems
- 01 Internal Combustion Engines
- 06 Vehicle Design Factors

**56 BIOMEDICAL SCIENCES, APPLIED STUDIES**
- 03 Chemicals Metabolism and Toxicity
- 04 Other Environmental Pollutant Effects
- 01 Radiation Effects
- 02 Thermal Effects

**55 BIOMEDICAL SCIENCES, BASIC STUDIES**
- 30 Agriculture and Food Technology
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 06 Medicine
- 05 Metabolism
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health

**40 CHEMISTRY**
- 01 Analytical and Separations Chemistry
- 08 Combustion Chemistry
- 04 Electrochemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry

**01 COAL AND COAL PRODUCTS**
- 05 By-Products
- 40 Combustion
- 09 Environmental Aspects
- 60 Health and Safety
- 50 Marketing and Economics
- 20 Mining
- 04 Processing
- 06 Properties
- 70 Regulations
- 10 Reserves and Exploration
- 30 Transport and Handling
- 08 Waste Management

**20 ELECTRIC POWER ENGINEERING**
- 02 Environmental Aspects
- 01 Power Plants and Power Generation
- 03 Power Transmission and Distribution

**32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION**
- 01 Buildings
- 09 Education and Public Relations
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 02 Transportation

**30 ENERGY CONVERSION**
- 02 EHD Generators
- 08 Electromechanical Converters
- 05 Fuel Cells
- 01 MHD Generators
- 04 Thermionic Converters
- 03 Thermoelectric Generators

**29 ENERGY PLANNING AND POLICY**
- 10 Conservation
- 80 Consumption and Utilization
- 02 Economics and Sociology
- 60 Electric Power
- 01 Energy Analysis and Modeling
- 03 Environment, Health, and Safety
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 04 Natural Resources
- 06 Nuclear Energy
- 30 Policy, Legislation, and Regulation
- 05 Research, Development, Demonstration, and Commercialization
- 20 Supply, Demand, and Forecasting
- 07 Transport and Storage
- 90 Unconventional Sources and Power Generation
- 08 Waste Heat Utilization

**25 ENERGY STORAGE**
- 09 Batteries
- 04 Capacitor Banks
- 08 Chemical
- 02 Compressed Gas
- 05 Flywheels
- 07 Liquefied Gas
- 01 Magnetic
- 03 Pumped Hydro
- 06 Thermal

**42 ENGINEERING**
- 10 Combustion Systems
- 08 Electronic Circuits and Devices
- 02 Facilities and Equipment
- 01 General Engineering
- 04 Heat Transfer and Fluid Flow
- 03 Lasers
- 30 Marine Engineering
- 05 Materials Testing
- 40 Pollution Control Equipment
- 50 Power Cycles
- 06 Safety Engineering
- 20 Underground Engineering
- 07 Vacuum Engineering
- 09 Waste Processing Plants and Equipment

**52 ENVIRONMENTAL SCIENCES, AQUATIC**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

**50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

**51 ENVIRONMENTAL SCIENCES, TERRESTRIAL**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

**53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES**
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements
- 01 Social and Economic Studies

**45 EXPLOSIONS AND EXPLOSIVES**
- 01 Chemical
- 03 Explosion Detection
- 02 Nuclear

**70 FUSION ENERGY**
- 02 Fusion Power Plant Technology
- 01 Plasma Research

**06 FUSION FUELS**
- 03 By-Products
- 09 Environmental Aspects
- 05 Health and Safety
- 02 Processing
- 08 Properties
- 06 Regulations and Policy
- 01 Sources
- 04 Transport and Storage
- 07 Waste Management

**99 GENERAL AND MISCELLANEOUS**
- 05 Civilian Defense
- 03 Information Handling
- 04 Law
- 01 Management
- 02 Mathematics and Computers

**58 GEOSCIENCES**
- 04 Geochemistry
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 05 Oceanography

**15 GEOTHERMAL ENERGY**
- 07 By-Products
- 10 Direct Energy Utilization
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 02 Geology, Hydrology, and Geothermal Systems
- 20 Geothermal Data and Theory
- 09 Geothermal Engineering
- 03 Geothermal Exploration and Exploration Technology
- 08 Geothermal Power Plants
- 04 Legal and Institutional Aspects
- 01 Resource Status and Assessment

**57 HEALTH AND SAFETY**

**13 HYDRO ENERGY**
- 05 Economics and Management
- 06 Environmental Aspects
- 03 Plant Design and Operation
- 07 Power Conversion Systems
- 04 Regulations and Licensing
- 01 Resources and Availability
- 02 Site Geology and Meteorology

**08 HYDROGEN**
- 07 By-Products
- 09 Environmental Aspects
- 06 Industrial and Commercial Use
- 04 Marketing and Economics
- 01 Production
- 08 Properties
- 05 Safety
- 02 Storage
- 03 Transport

**44 INSTRUMENTATION**
- 03 Miscellaneous Instruments
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 01 Radiation Instrumentation
- 04 Well Logging Instrumentation

**07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY**
- 03 Isotopic Power Supplies
- 01 Physical Isotope Separation
- 02 Radiation Sources

**36 MATERIALS**
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 01 Metals and Alloys
- 06 Other Materials
- 04 Polymers and Plastics

**03 NATURAL GAS**
- 09 Artificial Stimulation, Plowshare, etc.
- 40 Combustion
- 03 Drilling, Production, and Processing
- 08 Environmental Effects
- 02 Geology and Exploration
- 05 Health and Safety
- 06 Marketing and Economics
- 10 Policy, Legislation, and Regulation
- 04 Products and By-Products
- 30 Properties
- 01 Reserves
- 50 Storage
- 20 Transport, Pipelines, and Handling
- 07 Waste Management

**05 NUCLEAR FUELS**
- 06 By-Products
- 05 Enrichment
- 30 Environmental Aspects
- 02 Exploration
- 04 Feed Processing
- 07 Fuels Production and Properties
- 40 Health and Safety
- 10 Marketing and Economics
- 03 Mining
- 50 Regulations
- 01 Reserves
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 20 Waste Management

**21 NUCLEAR POWER PLANTS**
- 08 Economics
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 05 Power Reactors, Breeding
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 09 Process Heat Reactors
- 07 Regulation and Licensing

**22 NUCLEAR REACTOR TECHNOLOGY**
- 02 Components and Accessories
- 04 Control Systems
- 05 Environmental Aspects
- 03 Fuel Elements
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety
- 06 Research, Test, and Experimental Reactors
- 01 Theory and Calculation

**04 OIL SHALES AND TAR SANDS**
- 06 Direct Uses and By-Products
- 03 Drilling, Fracturing, and Mining
- 10 Environmental Aspects
- 07 Health and Safety
- 08 Marketing and Economics
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 20 Regulations
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 09 Waste Research and Management

**09 OTHER SYNTHETIC AND NATURAL FUELS**
- 02 Alcohol Fuels
- 06 Gaseous Waste Fuels
- 01 Hydrocarbon Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 05 Liquid Waste Fuels
- 04 Solid Waste Fuels

**43 PARTICLE ACCELERATORS**
- 03 Auxiliaries and Components
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 01 Design, Development, and Operation
- 04 Storage Rings

**02 PETROLEUM**
- 50 Combustion
- 03 Drilling and Production
- 09 Environmental Aspects
- 02 Geology and Exploration
- 06 Health and Safety
- 07 Marketing and Economics
- 10 Policy, Legislation, and Regulation
- 04 Processing
- 05 Products and By-Products
- 30 Properties
- 01 Reserves
- 40 Storage
- 20 Transport, Pipelines, and Handling
- 08 Waste Management

**64 PHYSICS RESEARCH**
- 01 Astrophysics and Cosmology
- 02 Atmospheric Physics
- 03 Atomic, Molecular, and Chemical Physics
- 04 Fluid Physics
- 50 High Energy Physics

**65 PHYSICS RESEARCH (CONT.)**
- 90 Communication, Education, History, and Philosophy
- 80 Mathematical Physics
- 50 Medical Physics
- 10 Nuclear Physics
- 40 Radiation and Shielding Physics
- 60 Solid State Physics
- 70 Theoretical Physics

**14 SOLAR ENERGY**
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 20 Heat Storage
- 08 Ocean Thermal Gradient Power Plants
- 06 Photovoltaic Power Plants
- 01 Resources and Availability
- 10 Solar Collectors and Concentraton
- 05 Solar Energy Conversion
- 09 Solar Radiation Utilization
- 07 Solar Thermal Power Plants

**16 TIDAL POWER**
- 04 Economics
- 05 Environmental Aspects
- 03 Regulations
- 07 Tidal Power Plants
- 08 Wave Energy Converters

**17 WIND ENERGY**
- 01 Availability (Climatology)
- 04 Economics
- 05 Environmental Aspects
- 03 Regulations
- 06 Wind Energy Engineering

**CORPORATE INDEX**

**AUTHOR INDEX**

**SUBJECT INDEX**

**CONTRACT NUMBER INDEX**

**REPORT NUMBER INDEX**

# ENERGY RESEARCH ABSTRACTS

## 01 COAL AND COAL PRODUCTS

*REFER ALSO TO CITATION(S) 33494*

32803 **(ORNL/TM—7960) Fossil-energy program. Progress report for July 1981.** McNeese, L.E. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 102p. NTIS, PC A06/MF A01. Order Number DE81030229.

This report - the eighty-fourth of a series - is a compendium of monthly progress reports for the ORNL research and development programs that are in support of the increased utilization of coal and other fossil fuel alternatives as sources of clean energy. The projects reported this month include those for coal conversion development, chemical research and development, materials technology, component development and process evaluation, technical support to major liquefaction projects, process analysis and engineering evaluations, fossil energy environmental analysis, flue gas desulfurization, coal preparation waste utilization, atmospheric fluidized bed coal combustor for cogeneration, TVA FBC demonstration plant program technical support, PFBC systems analysis, fossil fuel applications assessments, performance assurance system support for fossil energy projects, international energy technology, generalized models for liquid and gaseous fuel supplies, analysis of coal production, and fossil energy information center.

### 0104 Processing

*REFER ALSO TO CITATION(S) 32860, 32861, 32862, 32866, 32867, 32895, 32952, 32959, 33080, 33081, 33082, 33255, 33256, 33547, 33871, 34125*

32804 **(ANL—81-30) Materials technology for coal-conversion processes. Progress report, January-March, 1981.** Ellingson, W.A. (Argonne National Lab., IL (USA)). Jun 1981. Contract W-31-109-ENG-38. 47p. NTIS, PC A03/MF A01. Order Number DE81028474.

Microprobe studies of reaction layers on refractories exposed to a high (20 wt %) iron oxide acidic coal slag suggest that the amount of iron oxide in the reaction layer immediately adjacent to the slag increases significantly as the chromia content in the refractory increases. Waveguides were installed at the SRC pilot plant to monitor erosive wear. Installation of the ANL-designed erosion scanner at the Exxon Coal Liquefaction Pilot Plant was completed. Nondestructive tests of the HYGAS high-pressure cyclone separator showed that the cyclone internal cone has eroded through in some areas. Evaluation of wear of the METC tar-separator cyclones and solids-separator cyclone continued; the addition of $B_4C$ hardfacing has reduced the wear rate in one of the tar cyclones. Preliminary tests have been conducted on the capability of an electromagnetic acoustic transducer to measure wall thickness. Work on passive acoustic methods to detect leaks in block valves continued. Work continued to evaluate the effect of combustion gas stoichiometry and deposits on the corrosion behavior of air and steam heat-exchanger tubes. Results indicate that high-chromium alloys such as Type 310 stainless steel exhibit a protective Cr oxide layer in the absence of a deposit; however, in the presence of a deposit, the scale characteristics are altered and sulfidation of the substrate material is initiated. This quarter, four sets of failed components (steam-oxygen injection twyers) from the Grand Forks Fixed-bed Slagging Gasifier were received for failure analysis. Metallography and SEM indicate that the cracking was due to thermal fatigue and the holes formed by burning or melting; deposits of a ferromagnetic material containing iron and chromium carbides were observed at the perimeter of the holes. 27 figures, 2 tables. (DLC)

32805 **(BNL—22952) Real time coarse particle mass measurements in a high temperature and pressure coal gasifier process treatment.** Wegrzyn, J.; Saunders, J.; Marlow, W. (Brookhaven National Lab., Upton, NY (USA)). Mar 1981. Contract AC02-76CH00016. 9p. (CONF-810319—3). NTIS, PC A02/MF A01. Order Number DE81030036.

From 3. symposium on the transfer and utilization of particulate control technology; Orlando, FL, USA (9 Mar 1981).

A sampling system has been designed and is under construction at Brookhaven National Laboratory that employs a probe appropriate for direct extracted sampling of erosive range particulate matter from a coal gasifier outlet or a high pressure fluidized bed combustor. The sampling train is scheduled to be tested at the Morgantown Energy Technology Center on their 42 inch coal gasifier unit. This sampling system consists of four modules: (1) a null balance extraction probe with injection through a porous lined tube to minimize wall loss, (2) a stem type virtual impactor to separate coarse from fine particles, (3) a filter tape collector, and (4) a Beta gauge total mass detector. The key design feature of this system is a stem type virtual impactor which separates at ambient gas stream conditions the coarse particles from the sampling stream so that at upon filtration no condensible vapors, find particles or reactive gases pass through the filter tape. This system should provide coarse particle mass flux data with a time resolution of thirty seconds or better. The probe attemps to maintain integrity of the sample and has high mass loading applications. The train is designed in module form so that it can be tailored to the particular needs of the process stream. The accuracy of the system and its components, including sampling, transport, and detection have to be determined. Accuratemeasurement of the aspiration velocity and setting of the isokinetic conditions appears to be a problem.

32806 **(BNL—29953) Real-time coarse-particle mass measurements in a high-temperature/pressure coal-gasifier process treatment.** Wegrzyn, J.; Saunders, J.; Marlow, W. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 7p. (CONF-810261—1). NTIS, PC A02/MF A01. Order Number DE81030039.

From Conference on high temperature, high pressure particulate and alkali control in coal combustion process streams; Morgantown, WV, USA (3 Feb 1981).

A sampling system has been designed and is under construction at Brookhaven National Laboratory that employs a probe appropriate for direct extracted sampling of erosive range particulate matter from a coal gasifier outlet or a high pressure fluidized bed combustor. The sampling train is scheduled to be tested at the Morgantown Energy Technology Center on their 42 in. coal gasifier unit. This sampling system consists of four modules: (1) a null balance extractive probe with injection through a porous lined tube to minimize wall loss, (2) a stem type virtual impactor to separate coarse from fine particles, (3) a filter tape collector, and (4) a Beta gauge total mass detector. The key design feature of this system is a stem type virtual impactor which separates at ambient gas stream conditions the coarse particles from the sampling stream so that at filtration no condensible vapors, fine prticles or reactive gases pass through the filter tape. This system should provide coarse particle mass flux data with a time resolution of thirty seconds or better. Sampling requirements for high temperature, high pressure aerosols are defined and discussed according to sample integrity, artifacts of measurements, and validity of the signal. For a meaningful, unambiguous measurement, each of the above points must be addressed, and within this framework, this paper describes the direct sampling probe that is being developed.

32807 **(CONF-810381—) Design properties of coal liquids: edited workshop proceedings.** Brinkman, D.W.; Reilly, M.J. (eds.). (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). Aug 1981. 173p. NTIS, PC A08/MF A01. Order Number DE81029342.

From Design properties of coal liquids conference; Checotah, OK, USA (2 Mar 1981).

The advent of synfuels will require a large measurement and modeling effort of new thermodynamic and physical properties. These data are required for the economic design and operation of proposed synfuel plants. The areas of data need are well defined. The pace of measurement will be restricted by laboratory availability. The cost for the required data and for their correlation and modeling will be substantial. And finally, the cost of doing all this work will be substantial. The plants we are talking about are energy plants and synfuel plants. They are energy intensive plants, and as such, they offer the prospects for a great deal of energy saving. To do so requires good data. In those critical areas where we start hunting the energy hogs, we will find that with +-20% data those hogs are pretty well hidden.

32808 **(CONF-810914—6) Thermolysis of naphthols.** Poutsma, M.L.; Dyer, C.W. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE81029684.

From International conference on coal science; Dusseldorf, F.R. Germany (7 Sep 1981).

A significant portion of the oxygen content of native coals and of the coal-derived liquids used as process solvents during hydroliquefaction of coal is present as phenolic hydroxyl groups. Various reported phenomenological effects of the phenolic content of process solvents on liquefaction performance have been reviewed. However, attempts to rationalize these on the basis of reactions at the molecular level are hampered by lack of background data concerning the chemical behavior of phenols under conditions representative of liquefaction. The object of this study is to provide such background by examining the thermolysis of representative phenols under carefully defined conditions. This initial report describes the behavior of the isomeric naphthols at 400°C in the absence of any purposely added reagents or catalysts. From the viewpoint of the chemistry underlying coal liquefaction, these results revealed a set of previously unrecognized thermal reactions by which phenols may be condensed to furans, be deoxygenated to arenes, and serve as hydrogen donors. These processes, the latter two generally desirable and the former one undesirable, are inherently related.

32809 **(DOE/ET/10104—8) Solvent-refined-coal (SRC) process. Quarterly technical progress report, July 1980-September 1980.** (Pittsburg and Midway Coal Mining Co., Englewood, CO (USA)). Jul 1981. Contract AC05-76ET10104. 219p. NTIS, PC A10/MF A01. Order Number DE81029628.

This report summarizes the progress of the Solvent Refined Coal (SRC) project. Included herein are summaries of three areas of contract work: the SRC Pilot Plant at Fort Lewis, Washington; the Gulf Science and Technology Company Process Development Unit (P-99) in Harmarville, Pennsylvania; and Research and Development technical support services conducted at Harmarville. The Fort Lewis Pilot Plant continued SRC-I mode operation until August 17 to complete the SRC-I Preheater B test program on the 2" coil. After a one week shutdown, operation was resumed in the SRC-II mode to repeat the low heat flux test program for Slurry Preheater B. Process Development Unit P-99 made three runs which were part of a series designed to study operations at low feed coal concentrations. Several modifications were made which will improve P-99 performance capabilities. Research and development technical support services accomplished are as follows. Experiments to study Feed Coal Effect on Kinetics were completed. Modeling and Simulation of SRC-II Reactor Systems included studies of heat loss in the P-99 and Fort Lewis reactors and control of unstable steady state reactor temperatures. In the area of Process Cost Model studies, work was initiated to develop the cost equation system which will be incorporated in the flow and yield matrices of the model. Studies of the effects of pyrite/pyrrhotite on Coking of SRC-II Process Streams were initiated this quarter.No conclusions have been drawn to-date from work in the field of Feedstock Preparation by Heavy Media Separation. Investigation of Feedstock Screening Methods added six runs to the coal liquefaction data base, and reactivity predicters were formulated which relate product yields to feed coal properties.

32810 **(DOE/ET/10154—T14) Evaluation of liquid-phase prilling as a technique for SRC solidification.** (Southern Co. Services, Inc., Birmingham, AL (USA); Catalytic, Inc., Wilsonville, AL (USA)). Aug 1981. Contract AC22-76ET10154. 27p. NTIS, PC A03/MF A01. Order Number DE81028419.

A process for solidifying solvent refined coal (SRC) by injecting molten material into a column of water was developed by E.I. duPont de Nemours & Company, Inc. It was tested in a series of short, pilot-scale experiments using a column 3 in. in diameter and a maximum of 10 ft high. The program was too limited to yield a definitive evaluation of the SRC prilling system, but it did establish within experimental limits, the technical feasibility of the process concept. Catalytic, Inc. conducted an engineering evaluation of the DuPont test results and developed a preliminary estimate of process costs for a prilling module sized to solidify 3400 tons of SRC per day. Catalytic's findings, summarized in this report, were that, while the process advantages contemplated by DuPont are probably valid, there are offsetting disadvantages which must be evaluated carefully before further effort is committed to process development.

32811 **(DOE/ET/10325—T11) Cryogenic methane separation/catalytic hydrogasification process analysis. Quarterly report.** Klosek, J. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Aug 1981. Contract AC01-78ET10325. 42p. NTIS, PC A03/MF A01. Order Number DE81029123.

In both the Rockwell and the Exxon gasification processors, the desired product methane needs to be separated from the reaction products and some of the other synthesis gas products recycled. This separation is not easy and cryogenic methane separation results from the Rockwell process gas at 932 psia and containing 3725 ppM of benzene are reported. The benzene was recovered by partial condensation and carbon adsorption. Other details are given. In the Exxon process three preliminary plant designs for acid gas removal and cryogenic methane separation from the raw gas at 250 psig were evaluated. (LTN)

32812 **(DOE/ET/14674—16) High-mass-flux coal gasifier. Final report, Phase III,** Simpkin, A.J.; Montanino, L.N.; Reinhardt, T.F.; Ferger, T.M. (Bell Aerospace Textron, Buffalo, NY (USA)). May 1981. Contract AC01-79ET14674. 102p. NTIS, PC A06/MF A01. Order Number DE81029807.

This report describes the design, analysis, construction and test activities associated with bringing a short-residence-time, entrained-flow gasifier Process Development Unit (PDU) to operational status. The basis High Mass Flux (HMF) gasifier, incorporated in the PDU, operates at a coal through-put of twelve tons per day, a pressure of fifteen atmospheres and processes coal, oxygen and steam to produce a synthesis gas. When applied to the production of Substitute Natural Gas (SNG), the option exists to add secondary coal to the basic HMF gasifier, for the purpose of enhancing the methane content of the product. A secondary coal feed system was developed and its injection capability demonstrated in a cold flow test facility. Operability and performance of the synthesis gas stage of the HMF gasifier were demonstrated with Pittsburgh seam coal and North Dakota Lignite. Curtailment of testing precluded the conduct of any gasification tests with secondary coal injection. Included in the main program was a task to evaluate the effects of slag fluxing additives upon viscosity/temperature relationships for Pittsburgh seal coal slags. The testing associated with this task was conducted by the Alfred University Research Foundation (AURF).

32813 **(DOE/ET/14700—1) Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, October-December 1979.** Wiser, W.H. (Utah Univ., Salt Lake City (USA). Dept. of Mining and Fuels Engineering). Aug 1980. Contract AC01-79ET14700. 73p. NTIS, PC A04/MF A01.

Studies of the chemistry and catalysis of coal hydrogenation have been initiated with the construction of a flow reactor for extraction of coal and the development of analytical techniques. Work was initiated on the design of a rotor for $^{13}C$ nuclear magnetic resonance of solid coal and extracted coal. Studies on momentum, heat and mass transfer in a fluidized bed simulated conditions for coal hydrogenation and were used to investigate effects of particle size and solids loading. The catalytic upgrading of coal-derived liquids is investigated by studies of the catalytic denitrogenation, desulfurization, deoxygenation and cracking of model compounds. Aging of Co-Mo catalysts was found to reduce the number of active sites but not the nature of the sites. A Raney catalyst is being developed for the hydrogenation of carbon monoxide. Temperature programmed desorption was used to study the properties of an iron manganese oxide catalyst previously shown to give high yields of $C_2$-$C_{10}$ hydrocarbons.

**32814 (DOE/ET/14700—2) Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1980.** Wiser, W.H. (Utah Univ., Salt Lake City (USA). Dept. of Mining and Fuels Engineering). Aug 1980. Contract AC22-70ET14700. 70p. NTIS, PC A04/MF A01.

Analysis of a group of coal liquids produced by catalytic hydrogenation of Utah coals with $ZnCl_2$ catalyst was begun. Carbon-13 nuclear magnetic resonance and liquid chromatography techniques will be used to correlate chemical properties with hydrogenation reactivity. Equipment previously used for downflow measurements of heat and momentum transfer in a gas-coal suspension was modified for upflow measurements. The catalytic hydrodeoxygenation of methyl benzoate has been studied to elucidate the reactions of ester during upgrading of coal-derived liquids. The kinetics of hydrogenation of phenanthrene have also been determined. The catalytic cracking mechanism of octahydroanthracene is reported in detail. Studies of the hydrodesulfurization of thiophene indicate that some thiophene is strongly adsorbed as a hydrogen-deficient polymer on cobalt-molybdate catalyst. Part of the polymer can be desorbed as thiophene by hydrogenation. Poisoning of the catalyst inhibits the hydrosulfurization activity to a greater degree than the hydrogenation activity. Iron-manganese catalysts for carbon monoxide hydrogenation is studied to determine the role of iron carbide formation on selectivity. Pure iron catalyst forms a Hagg iron carbide phase under reaction conditions.

**32815 (DOE/ET/14855—6) Exploratory study of coal-conversion chemistry. Quarterly report, December 20, 1979-March 19, 1980.** (SRI International, Menlo Park, CA (USA)). 18 Jun 1980. Contract AC22-79ET14855. 30p. NTIS, PC A03/MF A01.

This report describes work accomplished under two tasks: Task A, Mechanism of Cleavage of Key Bond Types Present in Coals and Task B, Catalysis of Conversion in CO-$H_2O$ Systems. Under Task A, the mechanism of the anomalously rapid donor solvent conversion of ortho- and para-hydroxydiphenylmethanes to phenol and toluene has been shown to involve an ionically established enol-keto equilibrium followed by rate limiting homolytic scission of the weakly bonded keto form. Consistent with a rate-limiting second step, the overall conversion rate is not subject to catalysis of acids, bases, or radical initiators, substances which could increase the rate at which the tautomeric pre-equilibrium is achieved. The rate of conversion, however, is markedly enhanced by the addition of iron oxides, with the mixed oxide $Fe_3O_4$ being roughly ten times more active than $Fe_2O_3$. Addition of crushed fused silica was also found to significantly enhance the conversion rates. Under Task B, the conversion of coal to 50% benzene soluble coal products in CO/$H_2O$ systems displays a striking dependence on the pH of the starting aqueous phase (measured at room temperature). Thus below a starting pH of 12.6, the product benzene solubility is about 10% and steeply climbs to the 50% level under more basic conditions. The operation of the water-gas shift reaction parallels the conversion, with $CO_2$ and $H_2$ formed as product gases and CO consumed in the basic systems where conversion is effective. Hydrogen used in place of CO is ineffective. In a test of the intermediacy of formate in the system the use of potassium formate with nitrogen as the charge gas was similarly ineffective. Formate thus cannot be an intermediate in the conversion. The use of Mo(VI) (as molybdate) was effective, and a pH dependence on its operation was also observed.

**32816 (DOE/ET/14855—9) Exploratory study of coal-conversion chemistry. Quarterly report No. 9, March 20, 1980-June 19, 1980.** (SRI International, Menlo Park, CA (USA)). 19 Nov 1980. Contract AC22-79ET14855. 31p. NTIS, PC A03/MF A01.

This report describes work accomplished under two tasks: Task A, Mechanism of Cleavage of Key Bond Types Present in Coals, and Task B, Catalysis of Conversion in CO-$H_2O$ Systems. Under Task A, the very effective catalysis of carbon-carbon bond cleavage by iron oxides in hydroxydiphenylmethane structures has been further characterized. An electron-transfer mechanism offers the most likely explanation of the observations that (1) alumina and silica-alumina surfaces are less active catalysts than $Fe_3O_4$, (2) meta-hydroxydiphenylmethane is almost as subject to catalysis as para-hydroxydiphenylmethane, (3) diphenyl ether is less subject to $Fe_3O_4$ catalysis than diphenylmethane, and (4) ortho-methoxydiphenylmethane exhibits the same susceptibility to $Fe_3O_4$ catalysis as ortho-hydroxydiphenylmethane. Under Task B, this quarter we have completed the survey of possible metal catalysts present in the Hastelloy C autoclave. We have found that coal conversion in CO-$H_2O$ systems is effective when metal oxides such as $MoO_4$/sup =/, $Cr_2O_7$/sup =/, and $MnO_4^-$ are used as catalysts, but there is less or no coal conversion with $FeCl_3$ or $Ni(CH_3COO)_2$. While studying the fate of the catalyst after the reaction, we have isolated formate in the water-soluble fraction. This important information could help us in studying the role of formate in coal conversion. During this quarter, we have also studied the influence of reaction time and fresh CO on coal conversion in the presence of a catalyst. A striking result of 67% of benzene-soluble materials was obtained with an equivalent of 6000 ppM of Cr as sodium dichromate.

**32817 (DOE/ET/14855—12) Exploratory study of coal-conversion chemistry. Quarterly report, June 20, 1980-September 19, 1980.** (SRI International, Menlo Park, CA (USA)). 4 Mar 1981. Contract AC22-79ET14855. 35p. NTIS, PC A03/MF A01. Order Number DE81016136.

This report describes work accomplished under two task: Task A, Mechanism of Cleavage of Key Bond types Present in Coals, and Task B, Catalysis of Conversion in CO-$H_2O$ Systems. Under Task A, we have made additional measurements of catalytic carbon-carbon and carbon-oxygen bond cleavage in coal-related diphenylmethane and diphenyl ether structures. The results provide further support for, but do not definitely confirm, the tentative conclusion that the highly effective iron oxide catalysts involves oxidation to radical cation species. The homogeneous scission of carbon-oxygen bonds in diphenyl ether structure has also been studied. In the Task B studies of CO-$H_2O$ systems, we typically obtain 50% benzene-soluble product material from 20 min. reaction of beneficiated Illinois No. 6 coal. This conversion level is obtained with aqueous solutions either at a starting pH above 12.6 or in neutral solutions with water-soluble catalysts present. We have studied a number of catalysts, including the potassium or sodium salts of molybdate, chromate, manganate, and tungstate; all are effective in the 3000 to 6000 ppM range. A striking result is that sodium nitrate at 6000 ppM is as effective as the metal salts. We found that the nitrate was converted to ammonium ion; also, formate was detected in the product aqueous phase. Finally, we find that catalytic quantities of sodium formate in CO/$H_2O$ at pH 7 are effective in the conversion. However, in a control run in $N_2$/$H_2O$, with a quantity of sodium formate equivalent to twice the molar quantity of hydrogen transferred to the coal in a successful run, the coal was converted to a product totally insoluble in benzene and with a lower hydrogen content than the starting coal.

**32818 (DOE/ET/14943—T1) Flash hydropyrolysis of Western Kentucky No. 9 bituminous coal with catalysts. Final technical progress report.** (Cities Service Research and Development Co., Tulsa, OK (USA). Cities Service Technical Center). 31 Mar 1981. Contract AC22-79ET14943. 254p. NTIS, PC A12/MF A01. Order Number DE81029631.

Cities Service R and D Company operated a three-inch diameter-free fall flash hydropyrolysis reactor with one to three feet

variable heating zone on caking and non-caking pulverized coals. With caking coals, the reactor operated satisfactorily between temperatures of 1250-1550°F and between 900 to 950°F with and without catalyst additions. Non-caking coals could be treated at all ranges of temperatures with or without catalyst additions. Up to two pounds per hour of coal and four pounds per hour of hydrogen were fed into the reactor. Of the catalysts tested, zinc chloride proved most effective, but only at low temperature of about 900°F. At temperatures of 1250 to 1450°F, zinc chloride, as well as other catalysts, proved to be ineffective. At 1400 to 1450°F and 1000 psig with 0.5 seconds solids residence time, about 47 percent of the carbon in caking coals were converted into useful gas and liquid products: 10 percent BTX, 7 percent light oil, 10 percent heavy oil, 27 percent total oil, 12 percent methane, 8 percent ethane and 20 percent total gas. On a maf (moisture-ash free) basis, conversion was 24 percent oil, 21 percent gas, 12 percent liquor (sour water and ammonia) and 43 percent char. These FHP liquids are superior to the COED pyrolysis liquids.

32819 **(DOE/METC/SP—110) Surface Coal Gasification.** (Department of Energy, Morgantown, WV (USA). Morgantown Energy Research Center). Oct 1980. 48p. NTIS, PC A03/MF A01. Order Number DE81030183.

The United States Department of Energy program for Surface Coal Gasification has evolved over several years of R and D activities beginning with the Office of Coal Research and followed by a thrust from the Energy Research and Development Administration to build demonstration plants and a growing realization that the United States technology base, economics, and domestic manufacturing infra-structure requires stimulation to meet the targeted 1992 alternate-fuels goals established. In this setting, the US DOE Fossil Energy's pilot-plant program has assumed a dual role: (1) developing advanced processes and (2) expanding the technology base necessary to support potential demonstration-plant problem areas, optimization, and commercialization. The successful commercial application of surface gasification of coal could enable the United States to use from its vast deposits of coal to produce a wide variety of energy products and chemical feedstocks. The technology base is well developed and extremely flexible for converting coal into alternate products suitable for the demands of a broad and heterogeneous market and a wide array of users/owners. To meet the defined program objectives, several pilot plant and process-development operations are being conducted. Four of these operations are described in this report: Combustion engineering low-Btu entrained-bed gasifier; bi-gas high-Btu entrained-bed gasifier; Westinghouse Ash-Agglomerating Fluid-Bed Gasifier; and the Cities Services/Rockwell Short-Residence Time high-Btu Hydrogasifier. Gasification technology-crosscut conclusions and results of technical problems and issues common to the four pilot plants are discussed in detail.

32820 **(DOE/METC/SP—183) Advanced-gasification processes.** (Department of Energy, Morgantown, WV (USA). Morgantown Energy Research Center). Dec 1980. 66p. NTIS, PC A04/MF A01. Order Number DE81030184.

An analysis of the needs for commercial gasification reveals the following principal categories of information gaps that can be filled by programs already in progress or those readily initiated. The gaps are technology base need required for successful commercialization of both currently available and advanced-gasification processes. The needs are defined further in Table 2-1, which shows the current status of the technology data base. The need areas are classified as follows: Coal Preparation/Feeding/Fines Management, Reactor Design/Performance, Gas Cleaning/Cooling, Acid Gas Removal/Gas Shift and Conversion Data Base on State-of-the-Art and Advanced Technologies, Components/Materials/Instrument Development, Health/Environmental/Safety, and General. It is anticipated that solutions to many of the problems associated with the demonstration plants, the alternative fuel plants, and the Synthetic Fuel Corporation endeavors will not be available during the design and construction phases. However, during the operating and optimization phases of most of these projects prior to commercialization, where additional troubles will surface, the technical-support program herein described will have provided the additional data base needed to correct deficiencies and/or to advance the state of the art.

32821 **(DOE/OR/03054—3) SRC-I quarterly technical report, January-March 1981.** (International Coal Refining Co., Allentown, PA (USA)). 1981. Contract AC05-78OR03054. 235p. NTIS, PC A11/MF A01. Order Number DE81027430.

Eleven engineering studies involved with the SRC-I coal liquefaction demonstration plant at Newman, Kentucky, have been entered individually into EDB and ERA. They involve, in particular, pollution control, materials handling of coal and plant residues, product upgrading, (LC-fining), chemical analysis of product and the analytical laboratory required at the demonstration plant and, finally, the solubility of hydrogen in coal liquids and model compounds. (LTN)

32822 (DOE/OR/03054—3, pp 1-9) **Ash concentrate conveying system.** 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, January-March 1981.

In the SRC-I Demonstration Plant, a Kerr-McGee critical solvent deashing (CSD) unit removes unconverted carbon and solid mineral ash from the primary liquefaction product, solvent-refined coal. The residue from this unit, Kerr-McGee ash concentrate (K-MAC), is sent to the gasification unit, where it is used to produce a hydrogen-rich synthesis gas. This study was conducted to determine the optimal method of transporting the K-MAC from the CSD unit to the gasifier; the K-MAC is similar to fly ash but it can ignite spontaneously. The first section of the report details results from a preliminary Phase I trade-off study, which compared five transport systems (vibratory conveyors, screw conveyors, dense-phase pneumatic conveyors, air-slide systems, and pneumatic pumping systems), based on Phase 0 design specifications. Since this initial study, design changes have altered the conveying distance, and more complete information on K-MAC characteristics has become available. As a result, the selection of a conveying method can be narrowed down to a choice between penumatic pumping systems and medium- or low-pressure dense-phase pneumatic conveying. The medium-pressure dense-phase method at 30 psig has been used for development of the process base line.

32823 (DOE/OR/03054—3, pp 11-17) **Coal storage study.** 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, January-March 1981.

During Phase 0 a coal storage area for the SRC-I Demonstration Plant was designed that could stockpile coal either over a long weekend in one 4-day pile or for 30 days in two 15-day piles. As coal was needed, it could be recovered from storage by a tunnel reclaim system and transferred to the process area through a system of conveyors. Subsequent studies at Air Products and Chemicals, Inc. (APCl) indicated that kentucky No. 9 feed coal from different sources might vary significantly. International Coal Refining Company (ICRC) recognized that a blending system should be studied, to ensure reasonable stability in plant operation. Also, ICRC's coal-supply action team determined that a 90-day emergency storage area might be needed as a source of coal during strikes or plant shutdowns. The study indicated the following: the total capital cost for a coal blending system is $18.5 million (1980 dollars); the maximum capital cost for an additional 60-days storage is $1.6 million, including engineering, site preparation, and a runoff retention system. Three more months of field work would be required, but the additional engineering man-hours would have negligible schedule impact. The final emergency storage system may not be based on 60 days, but the cost should be linearly related; with or without coal blending, the tunnel reclaim system was confirmed as the best method of reclaim from storage. Capital costs for tunnel reclaim are $300,000 less than those for the bucket-wheel stacker-reclaimer. Also, the bucket-wheel reclaim system does not allow sufficient flexibility for blending during coal reclaim.

32824 (DOE/OR/03054—3, pp 19-48) **Site confirmation study.** 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, January-March 1981.

To confirm Newman, Kentucky as the location for the SRC-I (solvent-refined coal) Demonstration Plant, this study evaluated the site, based upon established criteria. The study determined that the Newman, Kentucky site will support the proposed facilities in both the initial 6,000-ton-per-day (tpd) SRC-I Demonstration Plant and the future 30,000-tpd commercial plant. Approximately 90 pro-

ducing mines within a 50-mile radius make the site an excellent location to receive the high-sulfur coal used in the SRC-I process. The Newman site is also well situated from the standpoint of transportation, construction (labor), and utilities services. The Louisville and Nashville (L and N) Railroad provides major rail access to the site, and is currently serving 10 unit-train, coal-loading stations in western kentucky. The Green River, which flows into the Ohio River approximately 19 river miles downstream of the site, provides a navigable waterway that will easily support barge operations. The site and the surrounding region are adequately served by a highway system of primary and secondary roads. The topography of the Newman site will accommodate the proposed facilities. Soil conditions are suitable for planned structures with proper foundation preparation. In addition, demonstration and commercial facilities can be built on this site and meet all flood control, environmental, and engineering evaluation requirements. Power, the only off-site utility required for the proposed facility, can be made available by the utility companies serving the area. These companies presently offer the levels of service required for construction purposes, and preliminary plans are being drafted that will expand service to meet the needs of the demonstration plant, once it is operational.

32825 (DOE/OR/03054—3, pp 71-88) **Applicability of the industrial source complex dispersion model to the SRC-I Demonstration Plant.** Christiansen, J.H.; Boyd, R.R.; Schlosberg, J.A. 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, January-March 1981.

SRC-I plant air quality modeling was conducted to develop information for the 1981 Draft Environmental Impact Statement and to apply for a prevention of significant deterioration permit. Modeled pollutant emissions included sulfur dioxide, particulate matter, nitrogen oxides, carbon monoxide, volatile organic compounds, heavy distillates, lead, beryllium, mercury, fluorides, hydrogen sulfide, and carbonyl sulfide. These emissions will be released from over 40 point sources and myriad fugitive sources. These were modeled as 54 separate point, volume, and area sources. Each source will have unique emission characteristics, which include point, volume, and area source configurations. To validly assess the air quality impact of these point sources, the industrial source complex (ISC) model was used. One point source will have a negatively buoyant plume that requires a special algorithm to describe its unusual behavior. Consequently, the ISC model was modified to include a dense plume rise formula. Initial results disclosed the need for an engineering reevaluation of the emissions. During this reevaluation, ICRC corrected situations that could have resulted in unacceptable environmental impacts. This discussion is limited to initial development of input data for the ISC dispersion model and manipulation of output to give impacts that can be compared to existing standards. The ISC model is versatile and flexible because of its capacity to integrate area and volume sources, source schedules, and gravitational settling; although the model has limitations and modifications were made for certain specific problems.

32826 (DOE/OR/03054—3, pp 89-98) **Particulate control in process area 12 (solvent-refined coal process and deashing).** Wilks, W.H.; Wilkinson, P.D.; Schlosberg, J.A. 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, January-March 1981.

The 6000-ton-per-day (tpd) demonstration plant planned for construction in Newman, Kentucky is being designed and built to show technical and economic feasibility and environmental acceptability of the solvent-refined coal (SRC-I) process. Catalytic, Inc. is designing, engineering, and procuring equipment for the SRC process area of the plant (Area 12). This report describes Catalytic's approach to control of particulate emissions in Area 12, using established control technology. Four pollutant sources were identified: process heaters, process operations (coal-slurry drum and SRC solidifier), decoking, and fugitive emissions. To comply with federal and state environmental regulations, the following best available control technologies (BACT) were selected to control each source: efficient combustion techniques that minimize fuel consumption will control process-heater emissions; a venturi scrubber and condenser system will remove particulates from slurry-drum emissions; any remaining pollutants in the scrubber effluent will eventually be incinerated in the slurry heaters after this stream is combined with SRC-solidifier emissions; decoking drums (cyclone separators) and vent waste incinerators will remove particulates from emissions produced during periodic tube decoking of the process heaters; and hoods will capture fugitive particulates and exhaust them to a control system. Expected control efficiencies are discussed, and selected control technologies are rationalized.

32827 (DOE/OR/03054—3, pp 107-138) **High-conversion and low-conversion LC-finer runs.** 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, January-March 1981.

The SRC-I Demonstration Plant will include an LC-Finer to process a portion of the SRC product. LC-Fining will provide additional product flexibility in that SRC can be further upgraded by deep hydrogenation to produce more useful liquid and solid fuels, as well as naphtha, which can be hydrotreated and used as reformer feedstock for gasoline production. A two-phase pilot plant program was undertaken to provide data and information for the design of the LC-Finer. The first or high-conversion phase, involving a 45-day run in which 500°F$^+$ product was recycled with 50 vol % fresh SRC, was designed to yield a net conversion of 85 vol % fresh feed SRC. The second or low-conversion phase, consisting of a 30-day run in which 500 to 850°F product was recycled with 70 vol % fresh SRC, was designed to obtain a 50 vol % conversion of the SRC. Currently, demonstration plant design calls for operation in only one mode, which consists of processing one-third of the SRC through the LC-Finer at high conversion. An alternate design mode, in which two-thirds of the SRC is processed at low conversion, can be used in conjunction with the high-conversion process to enhance product slate flexibility, while decreasing hydrogen consumption. SRC for this program was received from the Wilsonville, Alabama Pilot Plant where it was prepared from Feis Mine Kentucky No. 9 coal containing less than 0.1% chloride and requiring no sodium carbonate addition during its preparation.

32828 (DOE/OR/03054—3, pp 139-149) **Development of SRC-1 product analysis.** Kingsley, I.S.; Kamzelski, A.Z.; Parees, D.M.; Schweighardt, F.K. 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, January-March 1981.

APCI reviewed the modified American society for Testing Materials procedure D2887 used by Wilsonville in place of time-consuming batch distillation to compute boiling-point distributions of coal liquids. This gas chromatographic (GC) technique, developed for the petroleum industry, is traditionally calibrated with normal alkanes. Because coal liquids are >90% aromatic, Wilsonville modified the standard D2887 calibration curve by including aromatics, phenols, and nitrogen bases. We confirmed that the relationships Wilsonville had made between GC retention time and a model compound's true boiling point are different for each of the major functional groups in coal liquids: saturates, aromatics, phenols, and nitrogen bases. Therefore, it is reasonable to assume that using a chromatographic standard based solely on aliphatics could bias the coal-liquid boiling point distribution curve and give false results. To establish the Wilsonville GC procedure at APCI, we had to demonstrate identical chromatographic conditions (retention times) and understand the calculation procedures used to derive the calibration curve. The Wilsonville procedure will then be used on coal process development unit (CPDU) samples to quantify the distribution of boiling points in process samples. We found that the addition of diluent (sometimes a distillate fraction of the same product) during laboratory batch distillation of total product liquid affects the weight distribution of material boiling above 550°F.

32829 (DOE/OR/03054—3, pp 151-224) **SRC-I Demonstration Plant analytical laboratory.** Palopoli, S.F.; Parees, D.M.; Slager, T.L.; Tewari, K.C. 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, January-March 1981.

Conventional hydrocarbon fuels can be characterized by many well-defined American Society for Testing Materials (ASTM) procedures. However, coal liquids are more complex and characterization is more difficult. Evaluations of standard analytical techniques such as capillary column GC and GC/MS on solvent-refined coal (SRC) derived liquids such as Wilsonville recycle solvent will determine their usefulness for monitoring and control in the demonstration plant. Quantitation of key constituents in the recycle sol-

vent might be used to derive a measure of solvent quality. The nature and size of the analytical laboratory needed at the demonstration plant is considered in some detail. A number of other tests are discussed: bromine number, mercaptan tests, sulfur analyses, ashes, etc.

32830 (DOE/OR/03054—3, pp 225-230) **Solubility of hydrogen in coal liquids.** Joshi, S.V. 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, January-March 1981.

To aid in determining the physical solubility of hydrogen in demonstration plant processes, data were compiled from several literature sources, including World War II studies, as well as more recent work sponsored by the Department of Energy and the Electric Power Research Institute. These data established that hydrogen solubility depends primarily on the pressure, temperature, and chemical nature of the solvent. Recent studies of several model compounds generally showed that solubility increases in a highly nonlinear fashion with temperature, although solubility values obtained for the same compounds by the various research groups differed considerably. Data also showed that solubility increases with decreasing molecular weight and increasing substitution on the aromatic rings; solubility increases as the structure of the solvent changes from paraffinic to aromatic to naphthenic. Data compiled on hydrogen solubility in several process solvents corroborated the qualitative trends derived from the model compounds, but yielded inconclusive quantitative comparisons. In terms of SRC-I Demonstration Plant processes, hydrogen solubility plays an important role in gas-liquid mass transfer, reaction kinetics/kinetic modeling, and process flows and equipment design. Because of the uncertainty in the literature data base, International Coal Refining Co. is planning to collect data on hydrogen solubility to aid in plant design. Determination of the physical solubility of hydrogen in coal liquefaction solvents under typical processing conditions is important because SRC-I processes always involve transport of molecular hydrogen from the gas phase to the liquid phase. In addition, it is impossible to predict the hydrogen mass transfer rates if hydrogen solubility cannot be estimated.

32831 (DOE/PC/30021—T4) **Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981.** Brockington, J.W.; Dyer, P.N.; Pierantozzi, R.; Brian, B.W.; Bauer, J.V. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Apr 1981. Contract AC22-80PC30021. 47p. NTIS, PC A03/MF A01. Order Number DE81028209.

Air Products and Chemicals, Inc., under contract to DOE, has begun a three year program in Catalyst and Reactor Development for a Liquid Phase Fischer-Tropsch Process. This program contains four major tasks: (1) Project Work Plan; (2) Slurry Catalyst Development; (3) Slurry Reactor Design Studies; and (4) Pilot Plant Facility Design. During the first quarter, Task 1 was completed. During this, the second quarter, work in Tasks 2 and 3 was actively underway. In Task 2, the computerized literature search of Fischer-Tropsch literature was continued, refinements in analytical procedures were implemented, the first 300 mL slurry reactor was completed, and catalyst screening tests were begun in the 15 mL gas-phase tubular reactor. Two of ten modified conventional slurry catalysts were prepared. Two batches of one of these catalysts, representing different pretreatment procedures, and a baseline Fischer-Tropsch catalyst were tested in the gas phase reactor. Eight metal cluster catalysts were screened in a gas phase reactor. In Task 3, construction of the 5" cold flow reactor simulator was completed and initial experiments begun. The persistant foaming problem associated with the use of kerosene as a cold flow liquid was overcome by using a $C_9$-$C_{11}$ isoparaffin mixture instead of kerosene.

32832 (DOE/PC/30041—T5) **Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981.** Dorn, H.C.; Taylor, L.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Jul 1981. Contract AC22-80PC30041. 20p. NTIS, PC A02/MF A01. Order Number DE81025961.

The operation of modern superconducting magnet based spectrometers in the liquid chromatography-proton nuclear magnetic resonance spectroscopy (LC-$^1$H) NMR mode is fairly simple. In light of the considerable improvements made in this technique, LC-$^1$H NMR has shown itself to be quite useful in fuel analysis. The limits of detection are now sufficiently low to be near that of the refractive index detector. Improvements in resolution (both chromatographic and spectroscopic) have made speciation within a class possible. The LC-$^1$H NMR technique increases the convenience and reliability of determining the average degree of substitution. Results are reported of runs made on a jet fuel and a model mixture which was prepared by mixing n-butylbenzene, m-xylene, tetralin, naphthalene, dodecane, isooctane, n-hexane, nonane, hexadecane and n-pentane.

32833 (DOE/PC/30041—T6) **Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, April 1981-June 1981.** Dorn, H.C.; Taylor, L.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Aug 1981. Contract AC22-80PC30041. 19p. NTIS, PC A02/MF A01. Order Number DE81029125.

In this paper on-line LC-$^1$HNMR analysis of coal recycle solvents is presented. This technique is also complimented with a GC-MS analysis of off-line LC-fractions.

32834 (DOE/PC/30080—4) **Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Annual progress report, February 1980-February 1981.** Cronauer, D.C.; McNeil, R.I.; Young, D.C.; Ruberto, R.G. (Gulf Research and Development Co., Pittsburgh, PA (USA)). Jul 1981. Contract AC22-80PC30080. 72p. NTIS, PC A04/MF A01. Order Number DE81030492.

Hydrogen transfer experiments using Powhatan No. 5 bituminous coal (Pittsburgh Seam) and labeled solvents are complete. The liquefaction runs with $d_4$-tetralin were made at temperatures of 300 to 450°C and at run times of 0, 10 and 30 min; additional runs were made with $d_{12}$-tetralin at 400 and 450°C. Product samples were examined by $^2$H-NMR to observe the site of deuterium transfer. The relative distribution of deuterium was primarily influenced by reaction temperature and not run time in spite of a major change in the absolute amount of hydrogen transfer with run time. Much of bituminous coal liquefaction occurs during the reactor heat-up time even though a low level of hydrogen transfer occurs. Therefore, the subsequent hydrogen (deuterium) distribution is strongly influenced by up-grading type reactions that occur. Hydrogen/deuterium exchange occurs to a sizable level at the severe conditions of coal liquefaction; this strongly affects the distribution of deuterium in the products. This exchange is enhanced by the presence of heavy aromatic species and by mineral matter and unconverted coal solids. Experimentation has been completed to show that the best instrumental approach to measure hydrogen donor capacity available to us is that of Seshadri et al., reported in Fuel (1978 and 1979). Results concerning the isolation of solvent fractions prior to $^{13}$C-NMR determination of hydroaromatics are discussed. Recycle runs with $^{13}$C labeled solvents have been made using octahydrophenanthrene, phenanthrene, methyl phenanthrene, dimethyl tetralin, and mesitylene. Analysis of the products is now under way.

32835 (DOE/PR/06010—T7) **Materials research for the clean utilization of coal. Quarterly progress report, April-June 1981.** (National Bureau of Standards, Washington, DC (USA). Center for Materials Science). 1981. Contract AI01-76PR06010. 27p. NTIS, PC A03/MF A01. Order Number DE81029477.

Effort this quarter has been concentrated on the book Construction Materials for Coal Conversion - Performance and Properties Data. The status of the various subsections of Section A (Materials Considerations and Performance Data) is: (1) Operating requirements - completed; (2) Performance Data and Candidate Materials - being drafted in final form. The assembling of test data for Section B is essentially complete and analysis of this data is in progress. Data was obtained on the creep of a fused cast $\alpha + \beta$ alumina (Monofrax A) under thermal cycling conditions and on silicon nitride using both linear variable differential transformers and specimen dimension measurements.

**32836 (DOE/RA/20222—2) Low/medium-Btu coal-gasification assessment of central plant for the city of Philadelphia, Pennsylvania.** (Philadelphia Gas Works, PA (USA)). Feb 1981. Contract FG01-79RA20222. 470p. NTIS, PC A20/MF A01. Order Number DE81028355.

The objective of this study is to assess the technical and economic feasibility of producing, distributing, selling, and using coal gas for industrial applications in Philadelphia. From the 15 sites considered, the Philadelphia Gas Works and Riverside sites were considered excellent candidates. Early in the gasifier selection study it was decided that the level of risk associated with the gasification process should be minimal. It was therefore determined that the process should be selected from those commercially proven. The following processes were considered: Lurgi, KT, Winkler, and Wellman-Galusha. A retrofit study was carried out to assess the impact on users having to switch from oil or natural gas to low or medium Btu gas. Medium Btu gas was selected in order to service many users with gas having generally useful combustion characteristics. Between the Lurgi and KT processes (which are competitive in terms of capital costs), the KT process shows a lower operating cost and is more flexible in terms of coal feed selection. In addition, the Lurgi (and the Galusha) gasifiers produce tars, phenols, and ammonia. Effective removal of these by-produces adds to the complexity and operating inconvenience of the overall process. Therefore, the KT process (which is unique in its ability to gasify many coals) was selected. The potential range of gas costs compares favorably with No. 6 fuel oil as an energy source. Although there exists an element of risk and uncertainty which must be bounded carefully during the next phase of the study, there also exists some potential for reducing the rather conservative cost estimate which represents the high case.

**32837 One-dimensional model for pulverized coal combustion and gasification.** Smith, P.J.; Smoot, L.D. (Brigham Young Univ, Provo, Utah). *Combustion Science and Technology ;* **23**: No. 1-2, 17-31(1980).

A one-dimensional model has been developed for pulverized coal combustors and gasifiers. The model describes the response of a coal particle system to its thermal, chemical and physical environment. Moisture vaporization, coal devolatilization, heterogeneous char oxidation, gas particle interchange, radiation, gas phase oxidation, primary and secondary stream mixing, and heat losses are considered. A predictor-corrector solution technique was used to solve the ordinary non-linear differential equations. Several combustor and gasifier predictions are shown. The model predictions are compared with experimental data. The effects of particle size and distribution are shown to be particularly important. Significant rate controlling processes include initial particle heat-up and char surface reaction.

**32838 Kinetics of oxydesulfurization of Upper Freeport coal.** Slagle, D.; Shah, Y.T.; Joshi, J.B. (Univ of Pittsburgh, Pa). *Industrial and Engineering Chemistry Process Design and Development ;* **19**: No. 2, 294-300(Apr 1980).

The kinetics of the oxidation of pyritic sulfur, organic sulfur, and carbon for the Upper Freeport coal are investigated. Experiments were conducted in a semi-batch manner. The effects of batch time (0-2400 s), temperature (150-210/degree/C), partial pressure of oxygen (0.69-3.44 MPa), and total pressure (3.44-6.88 MPa) were studied. Two alternate mechanisms have been proposed for the oxidation of pyritic sulfur. In one mechanism the fine pyrite particles are assumed to be uniformly distributed in coal particles and the continuous reaction model was found to hold where the rate of reaction is second order with respect to pyritic sulfur. In the other mechanism, the pyrite particles are assumed to exist free from coal and the shrinking core model was found to hold where the rate of reaction is controlled by diffusion through ash. Both the carbon oxidation and organic sulfur reactions are zero order with respect to carbon and organic sulfur, respectively. 14 refs.

**32839** (LBL—12000, pp 334-378) **Processes and techniques.** Connick, R.E. Jun 1981. NTIS, PC A24/MF A01. Order Number DE81027828.

In Materials and Molecular Research Division annual report 1980.

Topics studied were: formation of sulfur oxides from $SO_2$, coal conversion to clean liquid and gaseous fuels, organometallic chemistry of coal conversion, synthetic and physical chemistry, electrochemical systems, chemisorption of hydrocarbons on Ni and Pt, analysis of transplutonium elements in solution, transition metal-catalyzed conversion of CO, NO, $H_2$, and organic molecules to fuels and petrochemicals, electric conductivity of graphite-$AsF_5$ intercalation compounds, structure and thermodynamics of $GeF_6^-$ and $GeF_6^{2-}$ salts, structure of graphite fluorosulfates, and high-pressure phase equilibria in hydrocarbon-water (brine) systems.

**32840 Sulfidation resistance of high-temperature alloys tested in reducing and oxidizing atmospheres.** Hosier, J.C.; Harris, J.A. (Huntington Alloys Inc, WVa). *Industrial Heating (Pittsburgh) ;* **47**: No. 6, 14-16(Jun 1980).

The effects of pertinent elements on the resistance of specific high temperature alloys to reducing-sulfidizing and oxidizing-sulfidizing atmospheres are described. Twenty-six commercial alloys commonly used in high-temperature service were studied. Testing was conducted on rod specimens for a given sulfur potential, a threshold for the oxygen potential exists above which a protective oxide scale will develop. In a highly reducing environment, chromium in an alloy is important but not as protective as when some oxygen is present in the atmosphere. Aluminum, silicon, and a low nickel/iron ratio are all beneficial in resisting sulfidation in reducing atmospheres.

**32841 (ORNL/TM—7664) Failure modes and effects analysis of a coal-slurry preheater.** Mitchell, H.A.; Parsly, L.F.; Smith, A.N. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 33p. NTIS, PC A03/MF A01. Order Number DE81030425.

The Fossil Energy performance assurance program is concerned with the application of reliability, safety, and quality assurance techniques in the design and operation of the pilot plants and demonstration plants that exist or are being planned as part of the US Department of Energy fossil energy conversion programs. This report involves the application of one technique, failure modes and effects analysis (FMEA), on the safety and reliability analysis of the coal slurry preheater, a critical component in a typical coal direct liquefaction plant. The analysis identifies 55 potential failure modes. Fourteen of these events, if they should occur, would result in losses of sufficient magnitude to require special consideration in the design or operating phase to assure control of risk at an acceptable level. The report concludes that the FMEA could be a valuable tool in the identification of critical components for coal conversion systems. For maximum effect, FMEA needs to be used during the initial design phase. Its principal value is to determine high-risk failure modes, which could have unacceptable impacts on system safety and reliability/availability. The usefulness of FMEA will be improved if it is supplemented by the development of a failure data base; this data base could also be of value in selected cases as input to a more detaled technique such as fault-tree analysis.

**32842 (UCRL—50026-81-1) LLNL underground coal gasification project. Quarterly progress report, January-March 1981.** Olness, D.U.; Clements, W. (eds.). (Lawrence Livermore National Lab., CA (USA)). 27 Apr 1981. Contract W-7405-ENG-48. 42p. NTIS, PC A03/MF A01. Order Number DE81030634.

We have continued our laboratory studies of forward gasification through drilled holes in small blocks of coal, approximately 1 foot on a side. Such studies give insight into cavity growth mechanisms and particulate production. However, because of the small dimensions involved, the information these tests provide is necessarily limited to aspects of cavity growth at very early times. The preliminary process design of the Tono No. 1 field experiment in Washington has been completed. The experimental plan and operational strategy have been developed to ensure that the injection point remains near the bottom of the coal seam and that the experiment continues at least until a period of stable operation has been reached and sustained for a time. We have continued to develop a mathematical model for the small coal block experiments in order to further our understanding of the physical and chemical processes governing the burning of the coal and the growth of the cavity within the block. This model will be adapted, later, to larger-scale coal block experiments, and finally to full-scale field experiments. We hope to obtain scaling laws and other insights from the model.

Groundwater samples from wells located at distances of a few feet to several hundred feet from the gasification cavities were collected before, during, and after each of the Hoe Creek tests. The analysis of the groundwater contamination data pertinent to the Hoe Creek No. 3 test was completed. This is an ongoing project, and we will continue to obtain and analyze groundwater samples from these test sites.

32843 **Organically bound metals in a solvent-refined coal: metallograms for a Wyoming subbituminous coal.** Taylor, L.T.; Hausler, D.W.; Squires, A.M. (Virginia Polytechnic Inst. and State Univ., Blacksburg). *Science (Washington, D.C.)*; **213**: 644-646(7 Aug 1981).

Fractions of a solvent-refined coal that contain organically bound species of magnesium, calcium, titanium, iron, copper, or zinc have been isolated. The fractions represent a wide range of chemical types and molecular size. Their isolation is a step toward speciation.

32844 **Coal structure cleavage mechanisms: scission of methylene and ether linkages to hydroxylated rings.** McMillen, D.F.; Ogier, W.C.; Ross, D.S. (SRI International, Menlo Park, CA). Contract AC22-79ET14855. *Journal of Organic Chemistry*; **46**: No. 16, 3322-3326(31 Jul 1981).

The kinetics of the thermolysis of the coal-model compounds (hydroxyphenyl)phenylmethanes and p-hydroxyphenyl phenyl ether in tetralin at 400°C are described. The observed rates for (hydroxyphenyl)phenylmethanes are shown to be quantitatively consistent with thermochemical data and an enol-keto tautomerization followed by rate-determining homolysis of the cyclohexadienone intermediate. For p-hydroxyphenyl phenyl ether the breakdown of this quantitative agreement and the effects of various additives indicate that the tautomerization is rate determining and most probably involves electrophilic attack on the enolate ion. Implications for coal liquefaction and catalysis are briefly discussed.

32845 **Single-stage fluidized-bed gasification.** Pyrcioch, E.J.; Lau, F.S.; Punwani, D.V. Chicago, IL; Institute of Gas Technology (1981). 6p. (CONF-8104106—1).

From 3. technical contractors' conference on peat; Bethesda, MD, USA (29 Apr 1981).

The objective of this project is to conduct experiments to obtain data for the design of a single-stage, fluidized-bed, peat gasifier using steam and oxygen. The economics of converting peat to synthesis gas and to SNG by a single-stage fluidized-bed gasifier will also be evaluated. The equipment used in this project is the same as that used previously, with some modifications, to investigate the gasification characteristics of chars from Minnesota, North Carolina, and Maine peats. Some preliminary observations can be made concerning the results obtained to date. Increasing the oxygen-to-carbon feed rate increases the carbon gasified. For feed peat containing a relatively high moisture content (greater than about 20 wt %), increasing the gasification temperature from about 1620° to 1725°F does not significantly increase the carbon gasified. For peat with a low moisture content (less than about 10 wt %), however, increasing the gasification temperature does increase the amount of carbon gasified.

32846 **Hydrogasification PDU studies.** Paganessi, J.E.; Lau, F.S.; Punwani, D.V. Chicago, IL; Institute of Gas Technology (1981). 7p. (CONF-8104106—2).

From 3. technical contractors' conference on peat; Bethesda, MD, USA (29 Apr 1981).

For all thermal processes for converting peat to synthetic fuels, the feed moisture content should be about 50 wt % or less. Dry harvesting methods use solar energy to produce peat containing about 50% moisture. Wet harvesting methods produce peat containing 90 to 95% moisture, which must be dewatered to 50 wt % before being used. Several mechanical and thermal dewatering methods are commercially available and some improved methods are being developed. The particular method of peat harvesting and dewatering could affect the gasification characteristics of peat. Four different dewatering methods have been selected for testing. The effects of temperature, pressure, feed peat moisture content, and feed gas partial pressure on the gasification yields are the primary operating variables being investigated. The hydrogasification tests are being conducted in an existing entrained-flow reactor.

32847 **Diffusion and reaction in a stagnant boundary layer about a carbon particle--6. effect of water vapor on the pseudo-steady-state structure.** Sundaresan, S.; Amundson, N.R. (Univ of Houston, Tex). *Industrial and Engineering Chemistry Fundamentals*; **19**: No. 4, 351-357(Nov 1980).

The effect of modest amounts of water vapor on the combustion of a carbon particle surrounded by a stagnant boundary layer is investigated. Water vapor participates in the combustion by accelerating homogeneous oxidation of CO in the boundary layer and through the carbon-steam reaction. Small particles (<100 /mu/m) benefit very little from the presence of water vapor, while for large particles there is a significant enhancement in the rate of CO oxidation in the boundary layer. The qualitative features of the pseudo-steady-state structure are preserved for a wide range of water vapor concentration. Model calculations suggest that there would be significant CO and $H_2$ oxidation in the combustion zone of the Lurgi gasifier. 17 refs.

32848 **Comparison of independent product cost estimates: the cost of methanol from coal.** Kermode, R.I. (Univ. of Kentucky, Lexington); Jones, J.E. Jr. *Engineering Costs and Production Economics*; **5**: No. 2, 143-156(Sep 1980).

The interest in energy conversion processes has produced numerous cost estimates for a wide range of processes yielding combustible liquids and gases. As an example three recent studies of the cost of methanol produced from coal predicted costs ranging from 18.8 cents/gallon to 71.0 cents/gallon. Based on the relatively well established status of this fuel conversion technology, this difference in cost should be largely explainable. Examination of the three studies identified that the major sources of cost difference were coal quality, plant efficiency, economics of scale, operating and capital basis, the economic model, and choice of economic parameters. Almost complete reconciliation of the 52.2 cents/gallon cost difference was achieved when a common basis of evaluation was used.

32849 **Kinetics of coal liquefaction: effect of catalyst, H/sub 2/ concentration and coal type.** Lytle, J.M.; Wood, R.E.; Wiser, W.H. (Univ of Utah, Salt Lake City). *Fuel*; **59**: No. 7, 471-478(Jul 1980).

A process for dry coal hydrogenation-liquefaction has been developed that permits short residence times (seconds) and achieves notably high space rate utilization factors. The purpose of the work reported here is to identify more precisely the process variables that determine space rate utilization factors, and to express them in a kinetic scheme, in the hope of establishing more effective control of these variables in the process. Parameters considered important for an optimum space rate utilization factor are both chemical and physical in nature. Of special importance are heat transfer, catalyst concentration and hydrogen concentration. 22 refs.

32850 **Electrochemical gasification of coal--simultaneous production of hydrogen and carbon dioxide by a single reaction involving coal, water, and electrons.** Coughlin, R.W.; Farooque, M. (Univ of Conn, Storrs). *Industrial and Engineering Chemistry Process Design and Development*; **19**: No. 2, 211-219(Apr 1980).

Coals and other forms of solid carbonaceous fossil fuel are oxidized to oxides of carbon at the anode of an electrochemical cell and hydrogen is produced at the cathode. These gases are thereby produced in relatively pure states. The reaction proceeds at very mild temperatures and at operating electrical potentials lower than 1 V, i.e., significantly lower than the thermodynamic potential of water electrolysis. The process may be viewed as driven simultaneously by energy supplied at low temperatures in approximately equal proportions by the coal and by an external electrical source. It is expected that coal can supply a larger proportion of the energy if the process is operated at higher temperature for which the required electrical potential will be lower. 22 refs.

32851 **Simulation of coal conversion reactor environments.** Cooke, R.A.; Devereux, O.F. *Corrosion*; **36**: No. 4, 167-173(Apr 1980).

Recent emphasis on the gasification and liquification of coal to produce clean fuels has stimulated considerable study of the behavior of structural metals and alloys in the coal conversion reactor

environment. This environment is especially aggressive because of the presence of oxidants other than oxygen. In this work, two models simulating the coal gasifier environment are described; Model 1 comprises coal gas components and a molten sodium salt phase, while Model 2 also includes a solid carbon phase. The use of equilibrium constants to compute the equilibrium state of an open system and the occurrence of multiple equilibrium states are detailed. 18 refs.

32852 **Dynamic simulation of methanation reactors, interstage heat exchangers, and controllers.** Dissinger, G.R.; Johnson, S.H.; Stein, F.P. (Lehigh Univ, Bethlehem, Pa). *Chemical Engineering Communications ;* **4**: No. 4-5, 577-591(1980).

The RMProcess for methanation of coal syngas, which consists of six fixed-bed, adiabatic, catalytic reactors connected in series with interstage waste-heat boilers and feedwater preheaters to remove the heat of reaction, was successfully simulated dynamically using a mixed ordinary/partial differential equation model. Computer integration of the model was accomplished using the numerical method of lines. Controls were added to the model to regulate the temperature of the gas feed into the reactors by diverting some gas around the interstage heat-exchangers. It was found that the controller selection and tuning, although generally not a goal in large-scale simulations, was quite important. Conventional methods used to tune the controllers gave controller settings that caused a significant detrimental effect on numerical integration stability and efficiency. 11 refs.

32853 **Organic groundwater contaminants from UCG.** Mattroc, C.F.; Humenick, M.J. (Univ of Tex, Austin). *In Situ ;* **4**: No. 2, 129-151(1980).

The purpose of the research work described here is to identify and quantify the organic compounds that could contaminate groundwaters in the vicinity of in-situ gasification or under coal gasification (UCG) of Texas lignite. Field samples of groundwater and above ground condensate and tar from two sites in Texas were analyzed by gas chromatography-mass spectrometry. The extent of groundwater contamination was found to be a strong function of the water solubility of the organics. Based on limited sampling, water quality has appeared to improve over a one year period after gasification operations were completed at a field test site. 3 refs.

32854 **Continuous analyzer system for in-situ coal gasification project.** Kessler, R.C.; Wolfe, T.C.; Kinlen, P.J.; Fallert, D.L.; Combs, J.F. (Monsanto Co, St. Louis, Mo). *Advances in Instrumentation ;* **34**: 9-15(1979). (CONF-791005—).

From ISA national conference; Chicago, IL, USA (22 Oct 1979).

The paper discusses a system to monitor the gases evolved during the Pricetown 1 underground coal gasification field test. This system has been installed at the test site and is in operation. The analytical system consisting of a process mass spectrometer, two process gas chromatographs, and an NO/sub x/ analyzer will function under computer control and will automatically analyze gas samples from several locations in the coal seam as well as the product line. In order for the analytical system to function in near real time, a two stage sample preparation system was designed to remove solids and heavy oils in the first stage and light oils in the second stage so that a clean gas will be presented to the analyzer.

32855 **Failure analysis of coal-gasification pilot plant components.** Danyluk, S. (Argonne Natl Lab, Ill). *Coal Technology (Houston) ;* **3**: 223-261(1979). (CONF-791169—).

From 2. international coal utilization exhibition and conference; Houston, TX, USA (6 Nov 1979).

Some failed components from Synthane, the Morgantown Energy Technology Center, the Institute of Gas Technology (IGT) Steam-Iron, HYGAS and U-Gas, Westinghouse Waltz-Mill, and Grand Forks Energy Technology Center pilot plants are documented according to component, material, failure cause and recommendations for preventing future failures. Two failures from the IGT U-Gas pilot plant are discussed. 12 refs.

32856 **(DOE/ET/13060—T9(Vol.2)) Pipeline-gas demonstration plant: Phase I. Construction planning. Volume 1: safety procedures, temporary facilities, and labor survey.** (Conoco, Inc., Stamford, CT (USA); Foster Wheeler Energy Corp., Livingston, NJ (USA)). [nd]. Contract AC01-77ET13060. 207p. (FE—2542-40(Vol.2)). NTIS, PC A10/MF A01. Order Number DE81028444.

Contract No. EF-77-C-01-2542 between Conoco Inc. and the United States Department of Energy provides for the design, construction and operation of a Demonstration Plant capable of converting high sulfur, bituminous caking coal to clean pipeline quality gas. One of the assignments under the contract is to prepare construction plans for the Demonstration Plant. Temporary construction facilities will be provided by the Construction Management Contractor for its own use and for Conoco and DOE personnel. Some common facilities will also be provided for use by the subcontractors. A monitoring program will take place during the construction period to ensure minimal environmental impact. Safety procedures have been developed to cover the construction period. The labor and subcontractor supply situations have been surveyed and assessed for construction of the Demonstration Plant.

## 0105 By-products

*REFER ALSO TO CITATION(S) 32952, 32976*

## 0106 Properties

*REFER ALSO TO CITATION(S) 32807, 32828, 32829, 32830, 32832, 32843, 32902, 32915, 32917, 32947, 33509, 33606*

32857 **(CONF-810914—5) Statistical coal structure analysis cross polarization/magic angle spinning (CP/MAS)-$^{13}$C-NMR spectroscopy: quantitative evaluation of aromaticity parameters.** Hagaman, E.W.; Woody, M.C. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE81029683.

From International conference on coal science; Dusseldorf, F.R. Germany (7 Sep 1981).

In addition to the directly measurable carbon aromaticity of coals, fa, by CP-$^{13}$C NMR spectroscopy, the decomposition of the aromatic and aliphatic resonance bands into components arising from protonated and non-protonated carbons has also been accomplished. These NMR spectra present the interesting possibility of measuring hydrogen aromaticity given by fa/sub H/ = (C/H) fa/sub CH/ where C and H represent the number of atoms of these elements determined from the empirical formula of the coal and fa/sub CH/ is the fraction of total carbon in the coal which arises from protonated aromatic centers, i.e., CH/sub arom.//C/sub t/. Expression (1) utilizes the one-to-one carbon-hydrogen atom constraint of aromatic methines to equate the number of protonated aromatic carbons with the number of aromatic hydrogens. We have evaluated C/sub t/ using a double-labeling experiment consisting of chemically introducing methyl groups into coal via alkylation with $^{13}$C,$^{14}$C-methyliodide ($^{14}$C, 11.86 mC/mole; $^{13}$C, 18.56%). Radioassay of a weighed amount of the coal derivative in conjunction with its elemental analysis provides the ratio introduced carbon (gr-atom)/total carbon (gr-atom), C/sub int//C/sub t/. This quantity is taken as the standard against which the CP/MAS-$^{13}$ NMR integration, expressed as $CH_3$ resonance area/total carbon area, $CH_3$/C/sub t/, is measured.

32858 **(CSIRO—7) Mathematical analysis of factors influencing the development of mining-induced fractures around blind-ended openings with particular reference to Leichhardt Colliery.** Enever, J.R.; Shepherd, J. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Applied Geomechanics). Jun 1979. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE81904106.

A general mathematical analysis is presented dealing with the development of mining induced fracturing around the blind ends of underground openings. Results of this general analysis are compared with specific observations of mining induced fracturing occurring at the Leichhardt Colliery of Queensland Coal Mining Co., Ltd., Blackwater, Queensland.

32859 **(DOE/PC/40266—1) Measurement of fundamental properties characterizing coal minerals and fireside deposits. First quarterly technical progress report, 1 April 1981-30 June 1981.** Wagoner, C.L. (Babcock and Wilcox Co., Alliance, OH (USA). Research Center). Jul 1981. Contract AC22-81PC40266. 26p. NTIS, PC A03/MF A01. Order Number DE81030277.

This report is the first quarterly technical progress report on a project to develop detailed data on the physical characteristics and mineral constitutents of a low-rank coal and of the surface deposits and flyash which result from burning the coal. Milestones 1 and 2 have been delayed, pending resolution of the choice of coals for study in this project and execution of a subcontract with Pennsylvania State University. No adverse impact on the overall schedule is expected. Work is in progress and on schedule for designing the deposition test section. Conceptual designs are approximately ninety-five percent complete.

32860 **(DOE/PC/40787—1) Enthalpy measurement of coal-derived liquids. Technical progress report, May-July 1981.** Kidnay, A.J.; Yesavage, V.F. (Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering). 15 Jul 1981. Contract AC22-81PC40787. 14p. NTIS, PC A02/MF A01. Order Number DE81029481.

Enthalpy measurements were initiated on the model compound quinoline. Preliminary results are presented for the temperature region 186 to 732°F along isobars of 75, 100, and 200 psia.

32861 **(IS-M—330) Automated on-line determination of PPB levels of sodium and potassium in low-Btu coal gas and fluidized bed combustor exhaust by atomic emission spectrometry.** Haas, W.J. Jr.; Eckels, D.E.; Kniseley, R.N.; Fassel, V.A. (Ames Lab., IA (USA)). 1981. Contract W-7405-ENG-82. 18p. (CONF-810607—12). NTIS, PC A02/MF A01. Order Number DE81025527.

From Symposium on instrumentation and control for fossil energy processes; San Francisco, CA, USA (8 Jun 1981).

The Morgantown Energy Technology Center (METC), US Department of Energy, is involved in the development of processes and equipment for production of low-Btu gas from coal and for fluidized bed combustion of coal. The ultimate objective is large scale production of electricity using high temperature gas turbines. Such turbines, however, are susceptible to accelerated corrosion and self-destruction when relatively low concentrations of sodium and potassium are present in the driving gas streams. Knowledge and control of the concentrations of those elements, at part per billion levels, are critical to the success of both the gas cleanup procedures that are being investigated and the overall energy conversion processes. This presentation describes instrumentation and procedures developed at the Ames Laboratory for application to the problems outlined above and results that have been obtained so far at METC. The first Ames instruments, which feature an automated, dual channel flame atomic emission spectrometer, perform the sodium and potassium determinations simultaneously, repetitively, and automatically every two to three minutes by atomizing and exciting a fraction of the subject gas sample stream in either an oxy-hydrogen flame or a nitrous oxide-acetylene flame. The analytical results are printed and can be transmitted simultaneously to a process control center.

32862 (LBL—12000, pp 413-454) **Fossil energy.** Ross, P.N. Jun 1981. NTIS, PC A24/MF A01. Order Number DE81027828.

In Materials and Molecular Research Division annual report 1980.

This section reports on: electrode surface chemistry, deuterium analysis of coal by NMR, oil shale retort components, chemistry and morphology of coal liquefaction, coal liquefaction alloys test program, materials characterization in fossil fuel combustion products, solution thermodynamics of sulfites and sulfite oxidation mechanisms, process chemical parameters in aqueous $SO_2$ removal, and coal liquefaction research. (DLC)

32863 **Results of some index tests on coal at Cook Colliery, Queensland Coal Mining Company, Blackwater, Queensland.** Lama, R.D. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 22p. (CSIRO—11).

The results of some index tests on Castor seam at Cook Colliery include grain density and porosity, Schmidt hammer, fracture surface energy and irregular sample tests. Results indicate that porosity and fracture surface energy of coal samples taken from Cook Colliery are far higher than from Leichhardt Colliery. The compressive strength values obtained from Schmidt hammer tests and irregular sample tests give values comparable with those obtained from Leichhardt Colliery.

32864 **Analyses of the Pittsburgh coal seam from a northern West Virginia preparation plant.** McFadden, C.R.; Nice, L.L.; Simcoe, E.J. (WVa Univ, Morgantown). *West Virginia University Coal Research Bureau Technical Report ;* No. 171, vp(Jun 1979).

This report describes the washability characteristics, chemical analyses and washability curves for the Pittsburgh seam, sampled at a coal preparation plant in northern West Virginia.

## 0108 Waste Management

*REFER ALSO TO CITATION(S) 32826, 32862, 32880, 32881, 32883, 32886, 32888, 32890, 32891, 32892, 32893, 32924, 32925, 32927, 32946, 33647, 33663, 33742, 33762*

32865 **(BNL—24786) Solid-waste impacts of increased coal utilization.** Le, T.; Meier, P.M.; Rostoker, H. (Brookhaven National Lab., Upton, NY (USA)). Feb 1979. Contract AC02-76CH00016. 131p. NTIS, PC A07/MF A01. Order Number DE81030495.

This report identifies the solid-waste-management problems of the coal fuel cycle, with particular emphasis on mining waste, coal ash, and scrubber sludge disposal. A coal-utilization scenario prepared for an analysis of the Administration's National Energy Plan is used to identify issues, impacts and constraints in the mining, electric-utility, and industrial sectors. Waste management and disposal in the utility sector is judged as a tractable issue that would not significantly impede increased coal utilization given proper environmental engineering input to site selection and waste management practice, albeit at some cost due to other recently enacted Federal Legislation, particularly the Resource Conservation and Recovery Act and the 1977 Clean Air Act Amendments. In the industrial sector, a number of potental institutional and environmental problems are identified that pose significant constraints to increased coal utilization.

32866 **(DOE/MC/14784—T1) Preliminary study: use of low-sulfur coal and coal cleaning in control of acid rain.** (Zawadzki (Edward A.) Ltd., McMurray, PA (USA)). May 1981. Contract AC21-80MC14784. 38p. NTIS, PC A03/MF A01. Order Number DE81028930.

This preliminary study was undertaken as part of a larger DOE assessment of the acid rain problem and the feasibility of various control techniques. From among the many strategies that are proposed for control of acid rain, this study deals with two: (1) use of naturally occurring low-sulfur coal; and (2) cleaning of raw coal in preparation plants prior to firing. The distribution and ownership of the US coal reserves are discussed with emphasis on the reserves having low sulfur content. Some of the basic constraints on the availability and use of low-sulfur coals by utilities are enumerated. A preliminary estimate of the sulfur reduction potential of US coals achievable by coal preparation is presented. Also included are a brief analysis of coal cleaning costs and the effects of coal cleaning on other aspects of acid rain control. (DMC)

32867 **(DOE/PC/30233—T2) Treatment of coal-conversion wastewater with the powdered activated carbon-contact-stabilization activated-sludge process. First annual technical progress report, February 1, 1981-July 31, 1981.** Suidan, M.T.; Gee, C.S.; Deady, M.A.; Pirbazari, M. (Illinois Univ., Urbana (USA). Dept. of Civil Engineering). 1981. Contract FG22-80PC30233. 36p. NTIS, PC A03/MF A01. Order Number DE81026280.

The scope of work of the present reseach project is to evaluate the effectiveness of the powdered activated carbon-contact stabilization activated sludge process in the treatment of a coke oven wastewater. Nitrification and subsequent denitrification of the contact-stabilization clarifier effluent will also be evaluated. Emphasis during this research will be placed on determining the effect of sludge retention time and the PAC addition rate on the performance of the contact-stabilization process and the subsequent unit processes. Optimization of the contact and stabilization contact times will also be attempted.

32868 **Salt-soda sinter process for recovering aluminum from fly ash.** Mcdowell, W.J.; Seeley, F.G. (to to Department of Energy). US Patent 4,254,088. 3 Mar 1981. Filed date 27 Mar 1979. vp.

A method for recovering aluminum values from fly ash comprises sintering the fly ash with a mixture of NaCl and Na2CO3 to a temperature in the range 700*-900* C for a period of time sufficient to convert greater than 90% of the aluminum content of the fly ash into an acid-soluble fraction and then contacting the thus-treated fraction with an aqueous solution of nitric or sulfuric acid to effect dissolution of aluminum and other metal values in said solution.

32869 **(EPRI-CS—1984) Monitoring the fixed FGD sludge landfill, Conesville, Ohio. Phase II.** Hupe, D.W. (Baker (Michael), Jr., Inc., Beaver, PA (USA)). Aug 1981. 138p. NTIS, PC A07/MF A01. Order Number DE81904200.

Stabilized flue gas desulfurization sludge, (Poz-O-Tec) has been landfilled at the Conesville Power Station of Columbus and Southern Ohio Electric Company since January 1977. At the time of initiation of this investigation, the Conesville operation constituted the first full-scale application of the IU Conversion Systems, Inc. stabilization/fixation system. As such, a utility sponsored research program was considered necessary to determine if full-scale application of the IUCS system (1) reflects laboratory and pilot scale results; (2) provides an environmentally acceptable disposal alternative; (3) causes operating problems; and (4) meets current and anticipated regulatory agency requirements. An evaluation of the above aspects is on-going and is being conducted in two phases. Phase II investigations entail continual well sampling and water quality comparisons, Poz-O-Tec sampling and testing, documentation of disposal operation problems, and evaluation of the overall fixation system. This report contains the results of the First Interim of Phase II (divided into three interims). The work completed in both phases has been designed to be supportive to a groundwater modeling study that was also initiated by Battelle, Pacific Northwest Laboratories. This project will supply the utility industry with an unbiased evaluation of the IUCS fixation system as specifically observed at the Conesville Power Station. The system benefits and drawbacks will be identified for use by utility representatives in the evaluation of FGD sludge disposal alternatives.

32870 **(EPRI-CS—2009(Vol.3)) Coal waste artificial reef program, Phase 3. Volume 3. Engineering-economic evaluation of fixed coal waste block production and disposal. Final report.** Hayward, J.C.; Rothfuss, E.H. Jr.; Flick, W.J.; Balestrino, J.M. (Baker (Michael), Jr., Inc., Beaver, PA (USA)). Aug 1981. 50p. NTIS, PC A03/MF A01. Order Number DE81904224.

This report serves to document, summarize, and expand upon the overall research effort regarding ocean disposal of large volume coal combustion wastes. The major objectives are twofold: (1) to present general results and highlights of the research direction and progress to date; and (2) to utilize the favorable results of prior physical block mechanics and environmental research, and expand upon it by providing a detailed cost feasibility assessment of the ocean disposal process. The cost feasibility assessment is conducted by way of a specific case study approach. An industry-represenative, hypothetical seaboard power plant is designed so that the case study analysis can benefit from the use of typical coal waste product quantities and characteristics. Cost estimates (in constant 1980 dollars) are provided for the entire ocean disposal scenario, including coal waste block production; handling; transportation; ocean disposal; and monitoring. The costs incorporated both equipment and labor requirements to analyze total capital investment along with annual operation and maintenance expenses. The assumptions and operational characteristics of the ocean disposal case study scheme are explicitly stated to allow individual utilities to modify conditions. In this way, the universal cost feasibility methodology may be utilized on an individual site basis.

32871 (EPRI-WS—79-236, pp 14.1-14.36) **Survey of fly ash handling and removal systems; past, present and future practices and their effect on precipitator and baghouse reliability.** Piulle, W. (Electric Power Research Inst., Palo Alto, CA); Goldbrunner, P.R. Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

The flyash handling system in a modern, coal fired, utility power plant serves an important function which indirectly effects unit availability. Increasingly stringent environmental controls require unit shutdowns, or load reductions, if particulate emission regulations are not being met due to precipitator or baghouse malfunctions. Proper consideration of flyash handling system problems is required during the design phase of new or retrofit ESP or baghouse installations. Design of the system should provide for maintaining the ash in a dry, free flowing state during all modes of unit operation. This can be accomplished through use of hopper heaters, warm air fluidizing, and frequent or continuous evacuation of ash from the precipitator/baghouse hoppers.

32872 (EPRI-WS—79-236, pp 15.1-15.36) **Oil ash handling case history.** Horrigan, J.W. (Boston Edison Co., MA); McGreenery, P.A.; Houmans, J.J. Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

The main points developed in the paper are summarized: (1) After modifications, the dry oil ash handling system has proved to be both reliable and economical. (2) Operating experience has reemphasized the need to maintain the ash at a temperature above the dew point at every stage of the handling process. (3) To minimize plugging, ash cannot be allowed to accumulate in the silo or the precipitator hoppers; they must be maintained nearly empty. The ash must be kept moving. (4) In addition to close attention to design and installation, a continual program of inspection and maintenance is required to assure satisfactory performance of the ash handling system. (5) Reinjection improves the handling of the ash by reducing the volume of material to be handled and by eliminating the need to store flyash. It also reduces the problem of offsite disposal by making the ash more attractive to buyers. (6) The benefits of reinjection are somewhat offset by the increased fouling of the boiler; this causes problems with steam temperature controls and also requires more frequent cleaning.

32873 (EPRI-WS—79-236, pp 16.1-16.10) **Pneumatic conveying of fly ash in the pulse phase.** Homburg, E. (Aerodyne Development Corp., Cleveland, OH). Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

Recent developments in the pneumatic field have determined how to turn the saltation effect to an advantage. One approach is to allow a full plug to develop in a pipe and then create sufficient pressure to push the material through the line. This is an effective method and can be used to transfer materials ranging from submicron powders to 3/8" granules. P/A ratios of 15:1 to 100:1 can be achieved depending on material characteristics. Air pressure will range from 20 to 90 psig depending on system length and material characteristics. To convey long distances air boosters are used ranging from intermittent air injection to the use of a continuous internal trace line. These systems are applicable to powders such as

the fly ash generated by pulverized fuel fired boilers. However, this ash falls into the category of powders that can cause problems in the system described. The fly ash is a material that does not flow easily. Once at rest in a hopper it prefers to stay at rest. Therefore, it is necessary to fluidize or, at least, aerate the ash to promote flow. It now becomes difficult to control the aeration to the point where the desired rate of flow is induced and flooding does not occur. The flooding must be avoided to obtain the uniform flow required from a Dense Phase pressure vessel into its conveying line. Efforts to control this flooding led to the evolution of the Pulse Phase concept of pneumatic conveying. Figure 1 shows a typical method of creating Pulse Phase flow.

32874 (EPRI-WS—79-236, pp 17.1-17.20) **Bottom ash handling from the 50's to the 90's.** Foley, G.F.; Deininger, F.W. (Burns and Roe, Inc., Oradell, NJ). Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

Over the last 20 years several significant changes have developed to require re-evaluation of the conventional sluicing systems used for bottom ash removal. The bottom ash removal system has become a major consideration in power plant design and operation due to recent emphasis on clean air and water, the greater dependence on coal as a primary energy source, and the trend towards larger steam generating units. Depending on the exact coals selected for comparison and the degree of blending permitted, it is possible to double or even triple the amount of total ash collected when switching from eastern to western coals. Obviously, the increase in ash production places a greater load on the bottom ash removal system, both in capacity and frequency of use. The question of operational availability cannot be answered based on data available for US operating units since there are none. However, mechanical ash removal systems have been used as a major method of bottom ash removal in most European countries and based on their reports, mechanical ash removal systems have been used with great success. The availability analysis contained herein indicates that European designs may improve the overall performance of coal fired power generating stations. The next five years will be extremely important in demonstrating the success or failure of the mechanical ash removal systems proposed for several utility installations in the United States.

32875 (EPRI-WS—79-236, pp 18.1-18.16) **Design and operation of compact bottom ash basins for 500 MW of generating capacity.** Hirsch, E.G.; Aitken, A.H. Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

We designed and operated an inexpensive compact pair of bottom ash basins for the Brayton Point Station that consistently discharged a good quality water. After several initial design and operational changes, the basin's settling ability was sufficient to maintain the discharge permit's limit of 30 milligrams per liter daily for suspended solids. These basins received bottom ash sluice water from two 250 MW units burning primarily a West Virginia bituminous coal averaging 7 to 8 percent ash. We believe that our experience shows that most utility operators, when considering new or conversion units, will tend to favor a basin arrangement, over dewatering bins, even with station and site restrictions considered.

32876 (EPRI-WS—79-236, pp 19.1-19.10) **Ash disposal methods: Eastern and Western coal.** Reynard, J.H. (Wisconsin Public Service Corp., Green Bay). Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

One of the many problems coal burning plants have in common is the problem of ash and/or scrubber sludge disposal. This paper looks at some of the problems associated with fly ash disposal in Wisconsin. The scope is two-fold: (1) To describe the present disposal methods used for the ash produced from midwest and eastern coals, how these procedures have changed and some probable changes in the future. Also included in this discussion are the requirements that must be followed in the locating and development of new disposal sites in Wisconsin. (2) To describe the disposal facilities planned for a 300 MW unit under construction that will burn western coal. We recognize that western coal ash presents unique disposal problems and unique methods will be required to handle this fast-setting ash. The market potential for the sale of this ash will also be discussed.

32877 (EPRI-WS—79-236, pp 20.1-20.17) **Cost of ash disposal.** Niece, J.E.; Bahor, M.P. (GAI Consultants, Inc., Monroeville, PA). Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

Ash disposal system selection is greatly dependent on site topography and in-plant handling costs. In general, dry ash disposal is the least cost alternative for flat areas whereas wet ash disposal is the least cost option for valley disposal. However, this assumes that the valley is amenable to wet disposal. Although no overall system selection generalities can be made, certain trends have been identified for the specific conditions studied: The use of a liner significantly increased the cost of the ash disposal system and could alter the system selection from dry to wet or vice-versa; as the cost of in-plant handling system O and M is decreased, the use of dry disposal becomes more advantageous; as the volume of ash disposed is increased, the cost per dry disposed ton typically decreases; comparison of valley disposal sites is sensitive to in-plant ash handling costs; economic comparisons of valley disposal sites can be sensitive to the method in which site preparation and embankment construction is phased; in-plant handling system costs need further documentation and refinement.

32878 **(LBL—13063) Kinetics of reactions in a wet flue-gas simultaneous desulfurization and denitrification system.** Chang, S.G.; Littlejohn, D.; Lin, N.H. (Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 36p. (CONF-810394—1). NTIS, PC A03/MF A01. Order Number DE81029853.

From American Chemical Society symposium on advances in flue gas desulfurization; Atlanta, GA, USA (30 Mar 1981).

A number of processes currently undergoing development for simultaneous removal of $SO_2$ and NO/sub x/ have been based on either the oxidation of relatively insoluble NO to more soluble $NO_2$ or the employment of a water-soluble ferrous-chelating compound as a catalyst to aid in the absorption of the insoluble NO. These ferrous compounds have the ability to form complexes with the NO and thus promote the absorption of the NO. Once in solution NO/sub x/ can be reduced by the absorbed $SO_2$ to form molecular $N_2$, $N_2O$, or reduced nitrogen compounds such as $NOH(SO_3)_2^{-2}$, $NH(SO_3)_2^{-2}$, $NH_2SO_3^-$, and $NH_4^+$; while $SO_2$ is oxidized to sulfate. The kinetics and mechanisms of reactions involved in this system are discussed.

32879 **Particulate control for industrial coal fired boilers: the reverse gas fabric filter method.** Smith, G.C. Pleasant Hill, CA; Ecolaire Environmental Company (1981). 10p. (CONF-8104107—1).

From 12. annual Kentucky industrial coal conference; Lexington, KY, USA (29 Apr 1981).

The purpose of this paper is to provide, for coal fired boiler users, an understanding of the reverse gas fabric filtration method for fly ash control. The mechanisms of filtration and operation of this system are discussed, as are its important design features. A discussion of life cycle costs concludes that a reverse gas fabric filter unit often will be the evaluated best choice for coal fired boiler particulate control.

## 0109 Environmental Aspects

*REFER ALSO TO CITATION(S) 32825, 32842, 32853, 32911, 32925, 32950, 32953, 32956, 32957, 32958, 33722, 33723, 33737, 33742, 33743, 33744, 33759, 33762, 33769, 33776, 33778, 33779, 33780, 33781, 33782, 33783, 33816, 33825*

32880 **(ANL/LRP-TM—20) Proceedings: conference on the economics of mined-land reclamation.** (Argonne National Lab., IL (USA)). 1981. Contract W-31-109-ENG-38. 265p. (CONF-810945—). NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

The present status and the future of this relatively new research area are examined. With the costs of labor and material rising almost daily, and the legal requirements to reclaim becoming more demanding, it is absolutely essential that the most cost-effective methods be found to restore mined land. This conference brings together professionals in both research and in mining who are concerned with this problem and who are seeking genuine solutions. This report contains the full texts of the papers presented at the conference. The ultimate goal of this work is the development of efficient and cost-effective ways to return to productive use lands that have been disturbed by mining. Separate abstracts have been prepared for each presentation for inclusion in the Energy Data Base.

**32881** (ANL/LRP-TM—20, pp 3-36) **Economics of reclamation.** Yokell, M.D.; Sanders, G. (Energy and Resource Consultants, Boulder, CO). 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

The paper presents a conceptual approach to the economics of reclamation. Legal and economic approaches to the problem are contrasted. Reclamation is viewed as a joint product from mining along with mine output. Consequently, reclamation costs are treated as one type of mining cost in a framework where totaal cost minimization is the objective. A simple mathematical model is developed to illustrate these concepts. Reclamation costs are divided into pre-mining costs, topsoiling costs, regrading and backfilling costs, and revegetation costs. Preliminary data on total reclamation costs by category, region, and mining method are presented.

**32882** (ANL/LRP-TM—20, pp 37-44) **Public myths about reclamation.** Ashby, W.C.; Kolar, C.A. (Southern Illinois Univ., Carbondale, IL). 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

Most people seem to take for granted that recent governmental controls on stripmine reclamation represent progress in the public interest. If so, what did the public want. Apparently what the lawmakers heard included a large dose of myths proclaimed by so-called environmental groups and unquestioningly disseminated by the news media. These myths appear to stifle cost-effective innovation and ready acceptance of alternatives in reclamation. The public must now bear an enormous fiscal burden to support reclamation practices which may be unnecessary, and even harmful in terms of sound land-use planning. These things need not be and could be set right if the public were to understand the price it pays for not rejecting myths about coal mining. In truth, mining without federal regulation has resulted in much high-quality land, society does not necessarily have to choose between food and energy, topsoil (top dirt) replacement can be a bad thing, prime farmland may well not be worth restoring, original soils and vegetation cannot be replaced exactly as they were, highwalls and impoundments should be retained and put to good use and abandoned (pre-law) mine lands often have unique values which should not be destroyed in restoration to what was there before.

**32883** (ANL/LRP-TM—20, pp 45-54) **Economics of surface mine reclamation.** Wiener, D.P. 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

During the course of research over a 3-year period from the fall of 1977 through the spring of 1980, attempts were made to discern the true costs of reclamation at 15 major surface mines in 6 western states. Results show virtually no uniformity in accounting for, or reporting such costs, and actual figures cited ranged from $200 to $18,000 pr acre, from North Dakota to Arizona. Any discussion concerning the cost of reclamation, however, should take into account the fact that reclamation of surface coal mines to productive, native conditions has still not been achieved in the arid and semi-arid West.

**32884** (ANL/LRP-TM—20, pp 93-102) **Analysis of post-restoration agricultural management at the Iowa coal project demonstration mine.** Henning, S.J.; Anderson, C.E. (Iowa State Univ., Ames). 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

Research during the post-restoration period following reclamation at the Iowa Coal Project demonstration mine has shown that rotations with legumes are profitable. There also appears to be a beneficial effect of legumes on corn producton which can not be achieved by using additional amounts of commercial fertilizer. The income from coal mining averaged $450 per acre for each of the three years that the land was not used for agricultural production. That income will offset the losses sustained during the early post-restoration period when agricultural production is least profitable.

**32885** (ANL/LRP-TM—20, pp 111-122) **Reclamation versus land use transformation: a cost comparison.** Nieves, L.A. (Pacific Northwest Lab., Richland, WA). 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

Since the spring of 1979, the Pacific Northwest Laboratory (PNL) has been field testing a water-harvesting-based agricultural production system as a means of reclaiming strip-mined land. Though the technical feasibility of the PNL system is becoming increasingly apparent, economic feasibility and related issues may determine its potential application. This study compares the net present value of conventional reclamation techniques with that of reclamation using the PNL water harvesting system. The comparison is based on the differences between the income and the construction and production cost streams of the two systems and it indicates potential economic attractiveness of the PNL system in arid regions. In site of the favorable economic estimates, the PNL system faces several obstacles to implementation. It is not clear that the PNL system would comply with existing reclamation laws or that reclamation would be carried out in the event of farm failure. In addition, there is considerable uncertainty as to the costs of production and the size of a viable farm unit under the PNL system. The cost savings of the PNL system are such, however, that further investigation is warranted.

**32886** (ANL/LRP-TM—20, pp 123-146) **Valuation of surface mining design to improve post-mining land resources.** Keeney, T.A. (Vande Linde, Inc., Charleston, WV); Colyer, D. 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

Mountaintop Removal Mining is a surface mining procedure which allows maximum resource recovery with the subsequent potential for constructon of landforms containing minesoils with desirable properties, resulting in a superior natural resource base. Improved land resources, obviously, will be feasible only if mining procedures designed for their attainment do not eliminate the economic returns from the mining process. The costs of mining procedures conducted specifically with the improved resource in mind will have to be compared with the expected additional returns to determine if they are justified. Frequently, however, interpretation and use of overburden characterization data can actually complement fundamental least cost principles for reduced mining costs and improved minesoils. In addition to the apparent value of the creation of landforms with higher economic returns from intensified land use, a clear cut case of soil quality that can often be evaluated is pH or the lime requirement to achieve a desired pH. To the extent that reclamation results in land more adaptable to a use with higher economic returns, the post-mining value will be enhanced and total returns increased. Mining procedures conducted with the improved resource in mind must be evaluated by considering the additional costs and additional revenues that result from the future uses of favorable landforms and more fertile minesoils.

32887 (ANL/LRP-TM—20, pp 147-168) **Evaluation of the potential of alternative land use plans for surface mined land.** Sweigard, R.J.; Ramani, R.V. (Pennsylvania State Univ., University Park). 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

Attention has focused recently on the potential for reclaimed mineral lands to support a variety of land uses. Emphasis has been placed on the qualitative benefits of higher land use to society at large. Less consideration has been given to the economic benefits that may be derived from increased property values of reclaimed land. This is due, in part, to the failure to adequately identify benefit and benefactor. Traditional engineering economic analyses raise questions on such factors as: the benefits to be considered, their quantification, and the benefactor; conduct of the analysis; time value of money; and the relationship between public and private sector. This paper addresses these questions by presenting alternate approaches for evaluating postmining land use alternatives. Rather than rely solely on traditional economic analyses, the approaches presented combine various analytical tecniques taken from several disciplines and attempt to construct a sequential evaluation process which satisfies the requirements of economic viability and environmental and social acceptability.

32888 (ANL/LRP-TM—20, pp 169-187) **Analytical overview of practices, costs, and interdisciplinary relationships and trade-offs for reclamation planning in the coal industry with applications to non-coal.** Cwik, M.J. (Intermountain Resources, Ltd., Spokane, WA); Martin, T.W.; Fitch, W.N. 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

There is a significant need in the mining industry for developing and refining reclamation costs and for showing their relationships to interdisciplinary studies that are conducted in support of a reclamation plan. When viewed in their entirety, these costs and relationships become useful tools for decision making in early planning stages of a mine. This paper consists of an overview of the reclamation problem, a discussion of reclamation and economics, a breakdown of major reclamation factors, a discussion of reclamation costs, and a presentation of interactions between production, reclamation and interdisciplinary studies. Data and conclusions presented in this paper are the result of the author's experience in reclamation plus the result of literature research on the subject of reclamation.

32889 (ANL/LRP-TM—20, pp 191-202) **Northern Great Plains reclamation cost projections by computer.** Scott, M.D. (Montana State Univ., Bozeman). 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

Reclamation for any final land use should be done as economically as possible, and this requires careful pre-planning. A computerized planning tool, caled CLAIM, has been developed which will predict the costs of reclaiming coal surface-mined land in the Northern Great Plains to any of five major land uses, through the operation of a subsystem called TECON (techniques and costs calculator). The general cost ranking of the top ten commonly used reclamation techniques, from highest to lowest, is as follows: (1) toxic spoil rehandle; (2) strip and replace topsoil; (3) strip and replace subsoil; (4) grade spoils; (5) administration of reclamation program; (6) ripping of compacted spoils; (7) hand planting of shrubs and trees; (8) mulching; (9) fencing; and (10) buying seed. If reclamation costs are calculated in a uniform way, such as total cost per ton of coal, or acre, mined, the relative costs per mining stage, or method, from highest to lowest, are: (1) dragline opening cut; (2) dragline final cut; (3) dragline mine run; and (4) truck and shovel benches. The relative costs of reclaiming spoils to the five major land uses are, in decreasing order: (1) high human use (homes, industry); (2) cropland; (3) water-based recreation; (4) native vegetation (rangeland); and (5) wildlife management. By thoroughly evaluating different land use options and reclamation techniques in advance, by computer, the mine planner can avoid reclamation failures and possible regulatory fines.

32890 (ANL/LRP-TM—20, pp 205-221) **Dragline reclamation of abandoned contour mines.** Carey, D.I. (Mathtech, Inc., Lexington, KY); Lappi, R.L. 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

Current and potential dragline reclamation usage was evaluated for the US coalfields based on data gathered and analyzed during field surveys, literature reviews and contacts with manufacturers. It was concluded that current mining plans adapted to federal and state strip mine and reclamation laws limit the potential for dragline reclamation systems at active mine sites. At abandoned conventional contour mine sites in steep-slope areas such as central Appalachia, however, it was found that dragline reclamation systems have great potential application and may be the only practical solution to many reclamation problems. Alternative dragline systems were examined for restoring abandoned sites, and it was concluded that a tower excavator system offered superior characteristics and should be evaluated and developed under field conditions. A testing program was developed to provide a framework for the monitoring and analysis of cost, production and environmental data during a field demonstration of a tower excavator system.

32891 (ANL/LRP-TM—20, pp 225-241) **Costs of recontouring abandoned mined land.** Brady, T.M. (Bureau of Mines, Morgantown, WV); Bowen, P.; Consalus, G. 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

Nine abandoned coal mine sites in seven states are evaluated for the costs of recontouring. Comparative evaluations are made using conventional equipment, dozers and scrapers, and large equipment such as draglines and truck and shovel. These nine sites are representative of abandoned coal mined land. The engineering estimates show abandoned sites will be very expensive to reclaim.

32892 (ANL/LRP-TM—20, pp 243-257) **Economic considerations of reclaiming abandoned tailings ponds and dams.** Derby, G.K. (Bureau of Mines, Morgantown, WV); Perry, R.D. 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

A detailed reconnaissance of 11 tailings pond sites was performed by a four-member team consisting of an engineer or engineering geologist, a geologist/hydrologist, a soil scientist, and a revegetation specialist. Survey measurements were taken to determine surface area and quantity of tailings. Samples were taken to evaluate mineral composition, engineering characteristics, and soil chemistry. Mineral evaluation was performed to determine if specific tailings deposits contained values that could warrant site remining considerations or if they were devoid of mineral values, making them prime candidates for reclamation consideration. Potential safety and environmental hazards were determined. Where applicable, water samples were taken, and native plant species were documented. Semidetailed reclamation plans were developed for five of the study sites which stipulate methods, procedures, and cost estimates to reclaim each individual site. Possible productive uses of the tailings material and the site, which included the economic feasibility of reprocessing the tailings, were prime considerations in developing the reclamation procedures.

32893 (DOE/ET/12394—T2) **Develop a winch-drawn dozer blade equipment system: modification A010-spoil-plane for leveling surface mine spoils. Semi-annual technical progress report.** Stecklein, G.L. (Southwest Research Inst., San Antonio, TX (USA)). Jun 1981. Contract AC01-75ET12394. 38p. NTIS, PC A03/MF A01. Order Number DE81030390.

This report delineates the preliminary findings of a study to determine the feasibility of leveling surface mine spoil piles at a production rate of 2000 bank cubic yards per hour while reducing the costs by 50 percent as compared to current crawler mounted dozer reclamation practices. Three machine concepts were identified as feasible alternatives; a crawler mounted winch pulled dozer, an adaptation of a small utility dragline, and a bucket wheel excavator. Based on the primary program objectives with due consider-

ation to utility, durability, mobility, development costs, and the potential for mine acceptability, the dragline was indicated to be superior to the other concepts. Additional study will be required to determine the configuration most suitable for reclamation work as well as the environmental effects and the effects on health and safety at the mine site.

32894 (EPRI-WS—79-236, pp 21.1-21.13) **Control of the fugitive dust during the loading of trucks with western coal fly ash.** Rowsome, R.J.; Van Sickle, A.H. (Detroit Edison Co., MI). Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

Serious fugitive dust problems resulted from the handling and storage of Western coal and also during the loading of trucks with fly ash at Detroit Edison's St. Clair Power Plant. The properties of the fly ash made is impossible to achieve acceptable fugitive dust control using the existing silo unloading equipment and water sprays. This paper discusses the various approaches explored for solving the fly ash fugitive dust problem and describes how the installation of a foam system in the existing fly ash unloaders reduced the fugitive dust by at least 75 percent.

32895 **Environmental R and D needs for advanced power plants.** Cain, W.C.; Jahnig, C.E.; Shaw, H. (US EPA, Cincinnati, Ohio). *Chemical Engineering Progress ;* **76**: No. 10, 62-69(Oct 1980).

This article discusses environmental RandD needs of new systems including combined cycles, fluid bed combustion, fuel cells, and MHD. A generalized economic and engineering basis was developed to evaluate alternatives on a consistent and comparable basis, including costs for pollution control. A computer program was developed for calculating the present worth incentives for advanced technologies so that the environmentally oriented RandD costs could be estimated. In addition to air, water, and solid waste pollution criteria, evaluations are included on regeneration of sulfur sorbent in FGD scrubbing and fluid bed combustion. 29 refs.

## 0110 Reserves And Exploration

*REFER ALSO TO CITATION(S) 32914, 33386*

32896 **(DOE/ET/14692—T2App.A-D) Inventory of peat resources, Koochiching County, Minnesota.** Severson, L.S.; Mooers, H.D.; Malterer, T.J. (Minnesota Dept. of Natural Resources, St. Paul (USA)). 1980. Contract FG01-79ET14692. 99p. NTIS, PC A05/MF A01. Order Number DE81029750.

The subject of this report is the reconnaissance-level peatland survey of Koochiching County, Minnesota. Discussed are: geological setting; peat formation; and peat properties and classification. Included are maps and a list of selected DOE sampling sites. Distribution, tonnages, and energy value analysis of peat are described. (DMC)

32897 **(DOE/ET/14692—T2App.E) Inventory of peat resources Koochiching County, Minnesota. Appendix E. Site descriptions.** (Minnesota Dept. of Natural Resources, St. Paul (USA)). 1980. Contract FG01-79ET14692. 144p. NTIS, PC A07/MF A01. Order Number DE81029658.

This appendix contains supplementary data on the peat resources of Koochiching County, Minnesota. Included are site locations; peat profile descriptions, including underlying soil texture; vegetation descriptions; microrelief; and depth to water table.

32898 **(DOE/ET/14693—T3) Peat deposits of Dismal Swamp pocosins: Camden, Currituck, Gates, Pasquotank, and Perquimans Counties, North Carolina.** Ingram, R.L.; Otte, L.J. (North Carolina Univ., Chapel Hill (USA). Dept. of Geology; Kent State Univ., OH (USA). Dept. of Geology). Jul 1981. Contract AC01-79ET14693. 31p. NTIS, PC A03/MF A01. Order Number DE81029642.

Peat is present in the Dismal Swamp of northeastern North Carolina and southeastern Virginia. In North Carolina the peat is in 4 separate deposits located west, northwest, and north of Elizabeth City. In a few infilled channels the peat is up to 12 ft thick but most of the peat lies in broad shallow depressions and increases in thickness from 0 ft at the margins to 6 to 8 ft in the interior of the deposits. The deposits in North Carolina occupy an area of 76,800 acres (120 sq mi) containing about 68 million tons of moisture-free peat. The deposits greater than 4 ft thick occupy an area of 34,700 acres containing about 43 million tons of peat. The peat lies to the east of the Suffolk Scarp on the Pamlico Terrace. The surface elevation of the peat ranges from 15 to 20 ft. Two main types of peat are present: (1) a brown, decomposed fibrous peat usually found at the base of the thicker peats, and (2) a black, fine-grained, highly decomposed peat that usually overlies the fibrous peat. Both peat types contain large amounts of wood. The moisture content ranges from 40 to 94% with an average of about 81% and usually increases with depth and total thickness of the peat. Away from the margins and bottoms of the deposits, the average ash content is about 7%. Heat values for moisture-free, low ash peats range from 8700 to 10,900 Btu/lb with a median of 10,100. The sulfur content ranges from 0.2 to 0.7% with a median of 0.3%.

32899 **(DOE/RA/20029—T1) Exploration of coal and anthracitic carbonaceous shale resources, Narragansett Basin, Massachusetts and Rhode Island. Final report, 1 October 1979-30 April 1981.** Skehan, J.W.; Gill, G.E.; Raben, J.D.; Schapiro, N.; Murray, D.P. (Boston Coll., Weston, MA (USA). Weston Observatory). May 1981. Contract AC01-79RA20029. 86p. NTIS, PC A05/MF A01. Order Number DE81030895.

This report presents results of continuous core drilling primarily in two contiguous fields to evaluate the carbonaceous resource. The study also includes geological and analytical results, resource calculations, and evaluations of potential mining methods and conditions. Results of fieldwork and drilling in the Portsmouth, Rhode Island area have defined the coal-bearing structure as probably being a southerly plunging fold, with the western holes penetrating the western limb and the eastern holes penetrating the axial portion of the fold. The Portsmouth coal varies in thickness (2.0 to 12.0 feet) and quality, but the 17.08 million ton resource is classified as high rank anthracite/meta-anthracite based on U.S.G.S. classification. The incompetency of the roof and floor rock would tend to preclude underground mining methods. However, surface mining such as the open pit method would be feasible. In the Plainville, Massachusetts area, an E-W trending anticline was defined by fieldwork and exploratory drilling. The anthracitic carbonaceous shale seam folded by this structure varies in thickness (2.3 to 31.8 feet) and ash content along strike. Resource calculations, based on U.S.G.S. standards, yield 4.2 million tons of the anthracite carbonaceous shale which is now being successfully extracted by the open cut method at the Masslite Quarry.

32900 **Basic program for borelog coding of coal-measure sequences using microcomputers.** Mallett, C.W.; Bonner, G.W. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1981). 17p. (CSIRO—31).

A Basic program has been developed to build files of coded borelog information in coal measure sequences for use with SORD M100 ACE microcomputer. Files are stored on floppy minidisks with approximately sixty detailed bores averaging 250 m stored on a single disk. Bores may be graphically displayed at any scale.

32901 **Example of the use of point load testing and rock-quality designation.** Enever, J.R.; Yeates, R.; Lees, R. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1979). 10p. (CSIRO—10).

This report describes the results of index testing of core from exploratory holes in the Ellalong Colliery holding area of Newcastle Wallsend Coal Company Ltd. Points load testing normal and parallel to bedding was carried out, as well as rock quality designation logging. The results were compared with the corresponding borehole logs and with the results of laboratory strength tests conducted on adjacent sections of core.

**32902 (DOE/ET/14692—T1) Reconnaissance peatland surveys.** Rafn, E.F. (Minnesota Dept. of Natural Resources, St. Paul (USA)). [nd]. Contract FG01-79ET14692. 3p. NTIS, PC A02/MF A01. Order Number DE81029690.

The purpose of this project is to survey major peatlands in Minnesota that may have potential for energy use. Peatlands in Aitkin, Beltrami, Carlton, Koochiching, Lake of the Woods, and St. Louis counties were surveyed at a reconnaissance level. The quality and type of peat were determined, and representative peat samples were gathered and analyzed for Btu content, degree of decomposition, composition (proximate and ultimate), mineral content, bulk density, pH, and water content.

## 0120 Mining

*REFER ALSO TO CITATION(S) 32858, 32886, 32888, 32900, 32901, 33636*

**32903 (CONF-810714—3) Support selection for the multi-lift mining method.** Goode, C.A.; Jaspal, J.S.; Barczak, T.M. (Department of Energy, Pittsburgh, PA (USA). Pittsburgh Mining Technology Center). 1981. 16p. NTIS, PC A02/MF A01. Order Number DE81028754.

From Conference on ground control in mining; Morgantown, WV, USA (27 Jul 1981).

Large quantities of high grade coal exist in thick seams in the United States. Many of these thick seams are too deep to be surface mined and do not lend themselves readily to underground extraction. To develop the new mining technology required to effectively mine thick seams, the Department of Energy has entered into a Cooperative Agreement with Mid-Continent Resources, Inc. to demonstrate the multilift longwall mining technique in a 28-foot-thick seam at their L.S. Wood No. 3 mine near Redstone, Colorado. The seam will be extracted in two lifts, with a 5-foot natural partition of coal left between the upper and lower lifts. Proper selection of face supports is critical to the success of this project. Specifications were defined for the roof supports, and it was concluded that the supports selected must provide full coverage, yield at the legs, and have a 60-inch push-out cantilever that can be set at any position under full load. A Hemscheidt two-leg shield was judged as the best qualified candidate and was selected for the multi-life trial.

**32904 (CSIRO—2) Emphasis in overseas research on underground coal mining: geomechanical implications.** Enever, J.R. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Applied Geomechanics). Feb 1978. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE81904078.

Geomechanical implications arising from current overseas research and development into underground coal mining are discussed. The subject matter is divided into the three categories: high recovery mining methods; hazard detection and avoidance; and advance prediction of mining conditions. The information was gathered during a trip by the author to South Africa, Switzerland, Czechoslovakia, Poland, West Germany, France, UK, USA, and Canada.

**32905 (CSIRO—3) Preliminary evaluation of two stress-analysis computer programs based on the displacement-discontinuity and finite-element methods.** Warburton, P.M.; Enever, J.R.; Hebblewhite, B.K. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Applied Geomechanics). May 1978. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE81904077.

A range of stress analysis computer programs based on a variety of theoretical approaches is currently available. This report covers an initial evaluation of two recently developed programs (THREED and ASQUARE) to assess their respective operating limitations and applicability to solving problems of relevance to underground coal mining.

**32906 (DOE/ET/10033—T2) Analysis of the labor productivity decline in the U.S. bituminous coal mining industry. Final technical report .** Hill, F.E.; Cook, F.X.; Herhal, A.J.; Krohta, B.J.; Manuel, E.H. (Ayers (Emory) Associates, Inc., New York (USA)). Jun 1981. Contract AC01-78ET10033. 303p. (FE—3120-1). NTIS, PC A14/MF A01. Order Number DE81026286.

This study assesses the causes for the decline in productivity in United States surface and underground coal mining since 1969. It also analyzes the major reasons for differences in productivity among mines as they are today. Data for the analysis were obtained from a number of sources within the federal government, from every significant coal mining state and from visits to 120 cooperating mines. The major causes for the productivity decline in underground mines were: the 1969 Mine Health and Safety Act; union contract provisions, especially job bidding; labor instability; and higher prices relative to miners' wages. The major causes for the productivity decline in surface mines were: increased state and the federal reclamation requirements; the 1969 Mine Health ad Safety Act; union contract provisions, especially job bidding; higher coal prices relative to miners' wages; in some regions, under-utilization of capacity due to the limits on burning high-sulfur coal; and declining growth of scale economies. Current reasons for differences in productivity among mines are widely varied and in addition to the above factors include: geology, equipment, cleaning losses, contract terms, end-market, shift schedules worked, and relative management ability. The outlook for the future is that productivity can increase in both underground and surface mines, and will if supported by government policy and by adequate investments on the part of industry.

**32907 (DOE/ET/11268—T3) Evaluation of novel underground transport systems. Final report.** (Skelly and Loy, Harrisburg, PA (USA)). Jun 1981. Contract AC01-79ET11268. 134p. NTIS, PC A07/MF A01. Order Number DE81030279.

It is the objective of this study to assess the feasibility of new or novel underground haulage equipment for transporting personnel and supplies. The study analyzes novel equipment and conventional haulage systems to determine their relative impact on productivity and the cost per ton that is attributable to this segment of the mining operation. Novel equipment in its current design can potentially alleviate many of the personnel and supply problems encountered in United States coal mines. A review of rail haulage systems and European underground mining provides the basis for the introduction of three novel haulage systems: monorail, floor-mounted trapped rail haulage, and chairlifts. It was determined that monorail and floor-mounted trapped rail haulage systems exhibit the highest potential for domestic utilization with the floor-mounted system already in use in one Pennsylvania mine. Monorail haulage equipment along with conventional battery powered rubber-tired equipment and two rail haulage systems were theoretically applied to five different mine sizes. Each system was then reviewed on an economic, operational, maintenance, and safety basis. From each standpoint, the monorail compared favorably with the other haulage systems. MSHA personnel reviewed the available technical and performance data, theorizing that the inherently safe design of trapped rail haulage equipment should prevent the need for any new regulations that would pertain to the equipment. Industry spokesmen exhibited interest in determining how trapped rail haulage equipment could benefit their mining operations.

**32908 (DOE/ET/12532—T4) Mine demonstrations of longwall dust control techniques. Technical status report, July 31, 1981-August 31, 1981.** (Ketron, Inc., Wayne, PA (USA)). 9 Sep 1981. Contract AM01-77ET12532. 3p. NTIS, PC A02/MF A01. Order Number DE81030376.

The objective of this study is to evaluate the effectiveness of automatic variable delivery system of water for double drum shearer longwall sections in a coordinated, systematic program conducted at a few selected longwall test sections, and to make the results available to the entire coal mining industry. The demonstrations are restricted to double drum shearer sections, because this is where the respirable dust problem is most severe. These demonstrations should guide the coal mining industry toward the best available technology to control respirable dust with the least adverse impact

on coal production. Demonstration sites will be chosen to be representative of typical longwall double drum shearer sections to achieve maximum transferability of technology to the rest of the industry. Meetings were held with representatives of the following shearer manufacturers: Anderson Mavor (USA) Limited, Eickhoff-America Corporation, and Joy Manufacturing Corporation.

32909 **(DOE/ET/12542—T1) Development of a longwall water jet mining machine. Final technical report.** (Missouri Univ., Columbia (USA)). Jul 1981. Contract AC01-75ET12542. 200p. NTIS, PC A09/MF A01. Order Number DE81029742.

The contract initial objective was to construct a prototype longwall water jet mining machine and evaluate its performance by field testing the unit in a strip mine coal panel. The design of the machine, Hydrominer I, was based on USBM Contract H0232064. The second objective was to design and construct an improved cutting head, Hydrominer II, which would be tested in an artificial coal heading. The testing of Hydrominer I in coal indicated significant beneficial features resulting from the application of water jet cutting to coal mining. These features were the elimination of dust, the reduction of the danger of gas and dust explosions from machine generated sparks, the ability to cut a wider web with a lower haulage force requirement than for a shearer, and the production of larger coal with fewer fines. However, the production rate was limited by inherent machine design problems which prevented Hydrominer I from achieving its full potential. The design generated for Hydrominer II was intended to correct the difficulties of the first generation machine and allow the full productive capability of the concept to be achieved while retaining the beneficial features clearly proven in the field tests of Hydrominer I. However, the artificial coal in which Hydrominer II was to be tested did not respond to the jet cutting in a manner similar to that of coal. Therefore, no conclusions can be drawn in regard to the performance of Hydrominer II based on the artificial coal tests.

32910 **(DOE/TIC—11477) Method of investigations, estimation, and classification of roofs in mines in the United States of America for the selection of suitable mechanized support for longwalls. Report No. 1: January 1, 1977-March 31, 1977.** Kidybinski, A. (Glowny Inst. Gornictwa, Katowice (Poland)). Mar 1977. 17p. NTIS, PC A02/MF A01. Order Number DE81028714.

The basic objective of present research project is to test and classify roof rocks in US coal mines. It will enable: rational selection of longwall supports - mean load density and type of support - for various roof conditions; evaluation of maximum distance between support and coal rib side for different classes of mine roofs; and forecasts of conditions for roof control - regular caving initiation. As can be seen from the report, the CMI penetrometer system should be redesigned for maximum pressure of about 2000 $kg/cm^2$ to allow for testing of higher strength rocks found in US mine roofs. It is necessary to design a new type of penetrometric head and a pump. For in-situ testing of rocks in the full range of strength, a brief program of four-weeks investigation in selected US mines is presented. The proposed plan of the SOA report on roof testing and support selection is presented. After USDI approval of the suggestions CMI will continue the research project according to the schedule of Phase I, namely: four-weeks visit of CMI experts to the United States for preliminary in-situ estimations of rock strength; redesigning of the penetrometer system; and SOA report preparation.

32911 **(DOE/TIC—11481) Subsidence prediction and control. Phase I. The state of knowledge in Poland concerning the influence of mining exploitation on the surface. Final report.** Skinderowicz, B. (Glowny Inst. Gornictwa, Katowice (Poland)). Nov 1978. 43p. NTIS, PC A03/MF A01. Order Number DE81028719.

This report was prepared under an agreement reached between participants in the Maria Sklodowski-Curie Joint Fund Project. The occasion was the completion of a tour of US coal mines by Polish secialists under Research Project No. 14-01-0001-1451, Planning for Mining Areas: Subsidence Prediction and Control. Memorandum of July 18, regarding the meeting with the Fossil Fuels Extraction Division of the US Department of Energy is attached. The final report includes: brief outline of the geological and mining conditions and subsidence problems of US coal mines visited from June 12 until July 8, 1978; remarks and suggestions concerning subsidence prediction and control in the US on the basis of the inspected mines; and state-of-the-art compendium covering Polish methods and experience which can be applied to the US coal mines.

32912 **Study of the instability of a spoil pile in an open strip coal mine.** Cox, R.H.T.; Dunbavan, M. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1981). 43p. (CSIRO—23).

Spoil piles in the open strip mine at Goonyella in central Queensland were failing with increasing frequency. The Division of Applied Geomechanics undertook an investigation to establish the cause and mechanism of failure. This report describes one aspect of that investigation in which sub-surface instruments were installed in a potentially unstable spoil pile so that internal displacements could be monitored. Approximately 2 1/2 months after the installation of instruments the surrounding spoil failed. The site's history included various mining operations which resulted in spoil pile movements recorded by the instruments. An explanation of these results is presented and suggestions for improving the future stability of spoil piles are offered.

32913 **Two-wedge stability analysis based on energy principles.** Dunbavan, M. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 16p. (CSIRO—17).

The project Stability Problems in Open Strip Excavations and Spoil Piles resulted in a number of reports containing stability analyses of spoil piles. The methods used are discussed, and some additional methods described in geotechnical publications are considered. A detailed discussion of an energy-based analysis and recommendations for its further application are included. Some conclusions are made regarding the role of stability analyses in the design of spoil piles and the prediction of conditions resulting in slope failure.

32914 **Depositional environments in the Barabala Coal Measures: Moura, Queensland.** Mallett, C.W.; Flood, P.G.; Nguyen, V.V.; Ledger, P. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 31p. (CSIRO—19).

Five seams are mined by surface and underground methods at Moura. Study of highwalls and bore core allow the interpretation of deposition environments during coal measure accumulation with estimates of the geometry and scale of the original channels and sediment distribution systems. Peat formation was interrupted by a series of sediment influxes. These evolve upsection from predominantly sheet sands of meandering channels to thinnly bedded and markedly lenticular sequences of levee and overbank deposits.

32915 **Role of geomechanics research in Australian coal mines.** Gerrard, C.M. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 28p. (CSIRO—20).

From United Nations symposium on world coal prospects; Katowice, Poland (15 Oct 1979).

Geomechanics is becoming increasing important in Australian coal mining because of increased mechanization, establishment of mines in new areas, the need to work more difficult areas, and the need to lift recovery rates in underground mines. Geomechanics research relevant to the needs of the Australian coal mining industry is conducted by CSIRO, ACIRL and BHP as well as State government departments and universities. The three main areas for research that apply to both surface and underground mining, are; mining method selection, ground and strata stability, and ground movements. Topics discussed under mining method selection are the use of predevelopment data in mine design, underground mining method selection, and blast design for surface mining. The main problems affecting ground and strata stability during mining are the occurrence of outbursts and roof instability in underground mines and spoil pile and highwall instability in surface mines. Ground movement research centres on the influence of both underground and surface mining on overlying or adjacent surface developments.

**32916 Field assessment of hydraulic fracturing as a stress measurement technique for near-surface applications: Stage 1.** Wooltorton, B. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 15p. (CSIRO—22).

A field exercise involving hydraulic fracturing as a stress measurement technique was undertaken at the U.D.C. open strip coal mine at Blackwater in Central Queensland. The objectives of the exercise were to investigate the possible existence of a high horizontal stress regime at the mine, and to assess the feasibility of stress measurement by hydraulic in a shallow, soft rock environment. A total of five tests wre attempted at depths between 10 and 72 m. It was not possible to initiate hydraulically a vertical crack due to the preferential parting of preexisting discontinuities (vertical joints and horizontal bedding) and hence the magnitudes and directions of the principal horizontal stresses could not be determined. However, it was possible to measure the in situ stress acting perpendicular to a particular near vertical discontinuity, the orientation of which could be estimated. This near-horizontal stress was approximately six times the magnitude of the vertical stress estimated on the basis of overburden depth, which implies a very substantial horizontal stress field. Some practical implications regarding the use of the hydraulic fracturing technique in the Blackwater environment are also discussed and suggestions for future development are made.

**32917 Application of a roof bolt hole penetrometer to the determination of in situ strength of coal-measure sediments.** Enever, J.R.; McKean, R.M.; Crawford, G.R.; Lupton, G.T. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 28p. (CSIRO—27).

A description is given of a prototype version of a device for determining the in situ strength properties of coal measure sediments, by side wall loading of conventially drilled roof bolt holes. The results of initial evaluation trials are included, along with a treatment of the methods of analysis of results.

**32918 Analysis of factors influencing roof stability at Wallsend Borehole Colliery.** Enever, J.R.; Shepherd, J.; Cook, C.E.; Creasey, J.W.; Rixon, L.K.; Crawford, G.; Dean, A.; White, A.S. Mount Waverely, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 87p. (CSIRO—15).

A series of stress measurements performed in the roof and floor of the Young Wallsend seam at Wallsend Borehole Colliery have established the existence of a high horizontal stress. Studies of roof falls have revealed the presence of stiff layers with relatively low horizontal strength. A combination of these factors appears to be the principal cause of severe roof instability in the mine. A failure model has been developed which is essentially consistent with detailed observations in the mine. Safety factors were calculated according to this model, in order to evaluate areas of highest failure potential. In general, the results of this mathematical modelling were consistent with observed mine behaviour. Further mathematical modelling was used to assess the relative effectiveness of the current support system and also to investigate the potential benefit of stress relief techniques.

**32919 Microseismic monitoring at 53 Level, West No. 2 mine, Collinsville: a feasibility study.** McKavanagh, B.M. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 22p. (CSIRO—12).

Microseismic noise was monitored during negotiation of an overthrust fault at Bowen No. 2 Mine, Collinsville, Queensland. The low level of noise recorded suggests that the technique used may not be sensitive enough for the mining conditions. No outbursts occurred. A significant increase in noise level was recorded following a shot firing. Suggestions are made for extension of this work.

**32920 Stress measurement on the Wambo colliery holding and their interpretation in terms of roof conditions.** Enever, J.R.; Wooltorton, B.A.; Crawford, G.R.; Cunningham, D.; Dean, A.K. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 21p. (CSIRO—28).

A series of stress measurements conducted by surface hydraulic fracturing and underground overcoring in the roof strata above the Whybrow and Wambo Seams on the Wambo Colliery Holding are described. The results are related to roof conditions encountered to date in underground workings in the two seams. Implications for future underground extraction down dip from existing workings are also discussed.

**32921 Geomechanical considerations related to the choice of a working floor for a proposed longwall development.** Enever, J.R.; Yeates, R.; Dean, A.K.; Crawford, G.R. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1979). 24p. (CSIRO—14).

A series of in situ plate bearing tests were conducted on a variety of geological horizons occurring in the lower part of the Greta Seam, with a view to determining their relative suitability as working floors for longwall extraction in the Ellalong holding of Newcastle Wallsend Coal Co. The results of these tests are compared with the results of laboratory testing conducted on core recovered from drill holes in the area concerned. On the basis of test results, an assessment has been made of the likely performance of alternate floor horizons and their suitability considered in the light of factors such as commensurate roof conditions, quality of mining section, amount of stone required to be handled.

**32922 Initial mathematical modelling study of the relationship between underground working conditions and overlying surface topography with reference to the Western Coalfields, N.S.W.** Enever, J.; Shepherd, J.; Huntington, J. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1978). 24p. (CSIRO—5).

This report is concerned with an initial two-dimensional mathematical modelling study of the effect of topographic features on the stress distributions occurring in the roof strata of underlying coal seams. The significance of these distributions in relation to the working conditions encountered during development of the coal seams is discussed, particularly in terms of the situation pertaining to the Western Coalfields area of N.S.W. The study contained in this report forms part of a more general program being undertaken by CSIRO to investigate the correlation between surface features (geological structure, topography) occurring in the Western Coalfields Area and corresponding underground working conditions. In this report, the effect of stress modifications due to topography on working conditions is considered in its own right. It is likely however that the net influence on working conditions could result from the stress modification effect associated with topographic relief and the direct influence of geological structure (particular features having an influence from the surface through to the immediate roof strata) acting in combination. Interactive aspects will be the subject of a later report.

## 0130 Transport And Handling

*REFER ALSO TO CITATION(S) 32822, 32823, 32864, 32866, 32894, 32948, 33404, 33547, 33647*

**32923 (DOE/ET/15299—T1) Examination of potential transportation impediments to the movement of coal.** Beier, F.J. (Minnesota Univ., St. Paul (USA)). 1980. Contract AC01-79ET15299. 40p. NTIS, PC A03/MF A01. Order Number DE81028123.

The purpose of this study is to examine the relationship between carrier and utility for the movement of coal. Discussed are those utilities who feel they have made adequate plans for transportation to planned units, as well as those who have not been able to do so. Where transportation barriers appear to be significant, the nature of those barriers are examined in detail and suggestions are made how such barriers can be resolved.

32924 **(DOE/TIC—11482) Removal and recovery of fine size coal from coal preparation plant waters. Report No. 1: January 1, 1977-December 31, 1977.** Kozlowski, O. (Glowny Inst. Gornictwa, Katowice (Poland)). Dec 1977. 12p. NTIS, PC A02/MF A01. Order Number DE81028718.

The results shown in table 2 represent the action of flocculants only, dispersants only and combined flocculant + dispersant reagents compared with the behavior of chemically nontreated coal fines and minerals slurries.

32925 **(EPRI-WS—79-236) Coal- and ash-handling systems reliability conference and workshop proceedings.** Diaz-Tous, I.A.; Bell, R.J.; Brennan, R.J.; Lukas, R.W.; Paine, R.G. III. (Electric Power Research Inst., Palo Alto, CA (USA). Fossil Fuel Power Plant Dept.; Stone and Webster Engineering Corp., Boston, MA (USA)). Aug 1981. 626p. (CONF-8010214—). NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

A national conference and workshop on problems of coal- and ash-handling systems reliability was sponsored by EPRI on October 27-29, 1980. Following an introduction with an overview on storage and flow of solids, formal papers were presented at a series of sessions organized under the following topics: yard coal handling, inplant coal handling, frozen coal, fugitive dust, fly ash handling, bottom ash handling, and ash disposal. Some major conclusions reached from the meeting included (1) the need for better methods to measure coal properties and stockpiles; (2) the need to design coal- and ash-handling systems on a custom basis; and (3) the need to deal with coal-freezing problems from a total systems approach. The report also includes notes based on workshops that addressed the same topics. Twenty-three papers have been entered individually into EDB and ERA.

32926 (EPRI-WS—79-236, pp 2.68-2.77) **Feeding coal into a pulverizer at Monsanto's Soda Springs plant.** Womack, W. (Monsanto Industrial Chemicals Co., Soda Springs, ID); Tufts, W.; Carson, J.W. Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

In April 1977, Monsanto installed screw feeders and compactors based on the work described above. The installation was designed to feed two coal mills from a single bin using twin screw feeders/compactors. The bin/feeder arrangement was designed so that mass flow existed in the bin with either or both screws operating. The new feeder/compactor screw conveyors provide adequate sealing against mill pressure and require little vertical space, which was a critical factor at the plant. The initial cost was significantly less than that of enclosed belt feeders. Moreover, the screws can be calibrated and used for volumetric measurement by adding a revolution counter. Since the feeder/compactors have been installed, no interruptions in coal feed due to arching have been experienced. Mass flow from the storage bin to the screw feeders has been achieved and coal feed to the pulverizers is uniform. Motor overload problems have also been eliminated. The firm considers the unit to be completely successful as far as achieving a uniform feed to the coal pulverizer. The screws did show significant wear after approximately four months of operation but replacement screws have been ordered hard-surfaced to achieve longer life. There is no way to estimate the actual savings in production and labor costs resulting from the use of the new units. However, feeding problems, which were virtually a constant daily occurrence have been totally eliminated. In addition, maintenance costs have gone down dramatically, even including repair work on the high-wear areas which, as noted above, should now be reduced by hard-surfacing.

32927 (EPRI-WS—79-236, pp 2.78-2.91) **Feeding dry fly ash without flooding and flushing.** Turco, M. (I.U. Conversions Systems Inc., Horsham, PA); Gaffney, C.; Johanson, J.R. Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

Fly ash from the Columbus and Southern Ohio Electric Company Conesville Power Station must be stored and fed at controlled rates from 4 to 45 tph to an I U Conversions Systems Poz-O-Tec R waste management process. The initial version of the storage bin equipped with vibrating hoppers and vibrating feeders was plagued with floods and flushes making process control impossible. Modification to only the lower few feet of each hopper and the use of the screw feeders resulted in smooth volumetrically controlled feed with better than +- 5% accuracy. The problems of the originally designed and installed system have been eliminated. The flushing condition has not recurred since the modifications were completed. The mass flow hopper and screw feeders provide a consistent repeatable output through an unusually wide range of flow rates for this fine floodable powder. The accuracy on the 45 tph range is better than +- 5% by weight, thus illustrating the effectiveness of the special screw feeder in feeding volumetrically and thus controlling a sensitive process. The same design concept has been used on subsequent installations with excellent long term results, showing the desirability of the mass flow withdraw method for high volume controlled flow of dry fly ash.

32928 (EPRI-WS—79-236, pp 2.92-2.102) **Discussion: measuring the effectiveness of FCA.** Carson, J.W. (Jenike and Johanson, Inc., Billerica, MA). Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

Recognition should be made of the different ways in which frozen coal is handled and its implication to a test program to determine the effectiveness of an FCA. Much is available already in the way of test equipment and procedures to evaluate some of these conditions. However, for one major concern - namely that of breakup of material after a rotary dump - there is a need to develop new procedures and analysis since none of those which are currently available accurately reflects the varied conditions under which the material will be handled. Such development should receive major attention and be started soon since this method of handling is quite common and needs to be better understood.

32929 (EPRI-WS—79-236, pp 2.103-2.121) **Solving coal flow problems at Detroit Edison Company.** Moaveni, M. (Detroit Edison Co., MI); Carson, J. Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

During the extremely cold winters of 1976-1977, major coal flow problems were encountered at Detroit Edison's Monroe Power Plant, one of the largest coal-fired power plants in the world. Extreme winter weather conditions can prevail at this Plant for periods of up to five months. Due to the magnitude of these problems and their financial impact on the Company's earnings, extensive studies were conducted to find reasons for and solutions to these problems. As a result, major recommendations were made for extensive modifications to the coal handling system and development of new operating policies at the Plant. This paper provides an overview of the major areas of the coal handling system, their associated problems, a summary of the coal flow tests run and recommendations which were developed and implemented at the Plant. As a result of this work, no significant coal flow problems have been experienced since the beginning of the 1978-1979 winter season.

32930 (EPRI-WS—79-236, pp 3.1-3.26) **Estimating the equivalent availability of a coal handling system.** Pipis, J.S.; Rose, L.A. (Detroit Edison Co., MI). Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

A coal handling system is unique in that it is not required to perform its function continuously. Also at various points through the system, there are storage piles that will allow the power plant to continue to function even though certain equipment has failed. These two factors (storage and non-continuous operation), along with a variable coal demand, random time to failure and random time to repair, make it difficult to use traditional reliability engineering techniques. This paper discusses techniques used to evaluate the equivalent availability of a coal handling system and the associated engineering economics of various equipment arrangements. The authors believe that discrete event simulation is an effective

tool for evaluating various complex systems. However, it is imperative that the analyst understand the model completely. In addition, the model should be run with several different random number streams or with different seed numbers to insure that the differences are due to the system arrangement and not due to the order of the generated random numbers. In addition, statistical tests should be conducted to determine if the differences are significant or not.

32931 (EPRI-WS—79-236, pp 4.1-4.13) **Coal handling is more than material handling.** Mullins, R.A. Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

The weighing and sampling of coal is one of the more important coal handling duties of the Yard Coal Group. Not only is more attention being given to the coal going to the bunkers, but more attention is being given to the coal going to the storage pile. Larger units, increasing fuel costs, state and federal environmental requirements and information required for fuel adjustment rates by regulatory Public Service Power Commissions necessitate not only reliable, but provable data. Coal, however, is heterogeneous and special procedures are necessary for a sample to be considered reliable. Coal is also a large volume material and normally accepted tolerances for weighing may raise questions as to satisfactory storage conclusions. The proper handling and the problems associated with attaining such proper handling of coal during the weighing and sampling is analyzed. In addition to the axioms noted, there are several conclusions. Six of these are: (1) coal is heterogeneous and special procedures are necessary for a sample to be procured and to be considered reliable; (2) the weighing and sampling of coal is one of the more important duties of the Yard Coal Group; (3) weather can change both the quality and the quantity of the coal; (4) the fuel concepts of all who deal with the production and sale of electric energy from a coal fired generator starts first with the data on quality and quantity that is initiated by the Yard Coal Group; (5) zero tolerance should be the goal; and (6) coal handling is more than material handling.

32932 (EPRI-WS—79-236, pp 5.1-5.21) **Coal blending by continuous nuclear assay.** Tassicker, O.J. (Electric Power Reseach Inst., Palo Alto, CA); Gozani, T.; Buckler, R.J. Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

A continuous nuclear analyzer of coal (CONAC) based upon prompt neutron activation has been developed for assaying coal entering boiler silos prior to combustion. CONAC is especially useful for blending varieties of coal, either for combustion purposes or for controlling sulfur oxide emissions. A primary cutter diverts 1-30 tph of coal through CONAC where the coal elements and ash components are determined online as weight percent. Experiments on stationary 100 kg samples of coal of several ranks have shown that carbon, sulfur, hydrogen, nitrogen, chlorine, silicon, aluminium, calcium, titanium, potassium and iron can be determined accurately. Moisture is determined separately by a means of electro-magnetic techniques. Higher heating values and sulfur dioxide emission are derived and displayed. Several such units were constructed or are under construction. At Monroe plant of Detroit Edison, a sulfurmeter is being presently commissioned. It is used for control of blending of high and low sulfur coals to meet local $SO_2$ emission standards. A second unit, a rapid sulfurmeter is under construction for installation this winter at TVA's Kingston plant for rapid determination of sulfur content of trucked coal. A third unit - the CONAC is scheduled for completion in summer 1981. It will provide on-line in real time a total elemental, ash, moisture and Btu analysis of various coals used in TVA's Kingston generating station.

32933 (EPRI-WS—79-236, pp 6.1-6.24) **Evaluation of coal blending systems.** Morgan, J.; Mahr, D. Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

Coal blending can be used to meet $SO_2$ objectives. A variety of low and high sulfur coals from changing sources can be blended in different proportions to meet normal and ceiling limits for $SO_2$ emissions. Typical blends for Labadie and Sioux vary from 10% to 30% low sulfur coal depending upon the coal's characteristics and the variance analysis. If the emission criteria is altered or if coal sources change, both the Labadie and Sioux blending systems will be able to adjust to these variations. Because coal is not a consistent or homogeneous commodity, the evaluation of coal blending and blending systems should consider the effects on plant equipment and performance. The ability of the boilers, pulverizers, ash systems, precipitators, etc. to adequately function must be investigated. Like blending for $SO_2$ requirements, blending for efficiency requirements will enable the station to burn coal which otherwise could not be used. Coal blending can and is being applied to new as well as existing stations. Retrofitting coal blending systems to the Labadie and Sioux Plants was chosen by Union Electric as the best means to meet $SO_2$ objectives. It will give these stations the widest latitude in selecting coal. It will allow the operators to better control plant performance parameters. Coal blending will be retrofitted with minimal disruptions to ongoing operations. Most importantly, coal blending will permit the plant to easily change operating parameters in these turbulent times.

32934 (EPRI-WS—79-236, pp 7.1-7.36) **In-plant coal handling.** Colijn, H.; Vitunac, E.A. (Bulk Handling Systems, Inc., Pittsburgh, PA). Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

Since coal flow to the boilers requires a very high degree of reliability in order to avoid reduction in power generation, it is recommended to carefully analyze the flow properties of a particular coal or to review the range of properties of various coals intended for fuel. An effort must be made to utilize gravity forces as much as possible, as gravity is freely available. The use of flow aids, although useful, must be considered as crutches. Considering the increase in cohesiveness of many coals used as fuel today, it is recommended to use at least 3-feet diameter feeder inlet openings, or 6' x 2' slot openings. As a consequence, the center line spacing between boiler silos and pulverizers must be increased to at least 9 feet. The hopper configuration of the boiler bins requires steeper slope angles of at least 70 degrees with stainless steel liners and smooth surface finishes.

32935 (EPRI-WS—79-236, pp 8.1-8.22) **Overview of major causes of pulverizer failures.** Maloney, K.L. (KVB, Inc., Tustin, CA); Benson, R.C.; Diaz-Tous, I. Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

Large coal pulverizers have been identified by the Edison Electric Institute (EEI) surveys as one of the main auxiliary plant systems responsible for lost steam generation capacity of large coal-fired steam generators. The primary objective of this study was to document the major reasons for poor pulverizer performance. Coal type, mill design, maintenance and operational practices were investigated to uncover root causes of the failures. A second objective was the documentation of field modifications which may have improved the reliability and the performance of pulverizers. A data base of 469 mills, the majority larger than forty tons/hour capacity, was formed by surveying US utilities with coal-fired boilers. The data was obtained primarily through the use of a questionnaire sent to the participating utilities. The analysis of this data base combined with telephone interviews and seven field visits to utilities identified both design and operational problem areas in all of the mill types studied. The mill types represent those of the four manufacturers, Babcock and Wilcox, Combustion Engineering, Foster Wheeler, and Riley Stoker. Bowl mills, roll-race mills, planetizing roll mills, ball-race mills and ball/tube mills were the configurations evaluated. Five specific problem areas were identified and evaluated: (1) drive components; (2) grinding zone elements; (3) air system; (4) mill fires and explosions; and (5) boiler problems associated with the pulverizer. The root causes of these problem areas were identified and documented. Conclusions are discussed with recommendations for future research and development based on the need for upgraded reliability and equipment equivalent availability.

32936 (EPRI-WS—79-236, pp 9.1-9.36) **Coal handling in freezing weather present state-of-the-art and research needs.** Sargent, G.A.; Wold, C.; Kendrick, S. (Ford, Bacon and Davis Construction Corp., New York, NY). Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

A concerted effort was made to contact all utilities, coal mine operators and railroad coal specialists who were most concerned about solving the frozen-coal problem. Over fifteen chemical manufacturers of glycol or oil based freeze conditioners and half a dozen calcium chloride producers were contacted to secure data describing the particular advantages of their products and best methods of treatment. The utilities contacted burned 44% of the steam coal consumed in 1978. These utilites described the treatment and methods used by the miners supplying their coal. In addition, individual coal companies were contacted who collectively mined 35% of the coal produced in 1978. From analysis of the data gathered, it was determined that all facilities have a frozen-coal handling problem with varying degrees of intensity. Frozen coal may be found whenever the temperature remains below freezing for several days. The problems of handling coal in freezing weather are not new but the severe winters of 1976-77, 77-78 and 78-79 when extended periods of below zero weather, extending even into areas of the south, created a much more serious situation than had been experienced in the long succession of relatively mild winters prior to this time. The paper summarizes the most common coal-handling problems that occur and the methods presently used to reduce or correct them.

32937 (EPRI-WS—79-236, pp 10.1-10.19) **Total program approach to freeze conditioning: experiences of Toledo Edison.** Kraemer, F.W. (Toledo Edison, Co., OH); Krohn, D.; Martin, J.D.; Swain, Y.T. Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

Some of the decrease in coal handling problems in '79-'80 were a gift of Mother Nature. Temperatures averaged 5 to 10°F higher than in the previous winters, with no heavy rain or snow falls. In this average winter, the weather was severe enough for periods throughout the season to determine that the freeze conditioning agents did contribute to improved handling conditions. Only minor freezing occurred on the contract coal treated with propietary Product A. This amounted to a 3 to 4 inch bottom crust which extended 1/3 of the way up the sides. Heating the cars from 3 to 5 minutes prior to dumping eliminated all frozen coal. Top dressing eliminated the crusting observed in the past on the top of the cars. In light of the increased handlability of the coal, coupled with a significant decrease in energy and personnel, FCA's were judged to be cost effective. Toledo Edison believes in the program. They are recommending substantially the same program for the '80 - '81 season.

32938 (EPRI-WS—79-236, pp 11.1-11.11) **Reducing the frozen coal problem to manageable proportions.** Rosenberg, N.I. (Union Electric Co., St. Louis, MO). Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

We can offer the following comments regarding our program: (1) freeze conditioning agents are decidedly helpful - expensive, but helpful. Using them in combination with other aids - in our case, heaters to thaw the car doors and car shakers - we are confident that we can now unload most trains in no more than six hours. This contrasts with two to four hours in normal weather, but it also contrasts with 10 to 16 hours without FCA's. (2) A major problem of high overtime and worn out, frustrated coal crews has been sharply reduced. (3) Based on weather forecasts fair guidelines for deciding which shipments should be treated have been developed. (4) The most significant indicator of coal manageability to us is that we experienced no load reductions because of frozen coal last winter. (5) Finally, although we are much better prepared to deal with winter's problems this year than ever before, we also have a better appreciation of those remaining problems. The situation is now - at least for the most part - manageable.

32939 (EPRI-WS—79-236, pp 12.1-12.13) **Chemical crusting of coal stockpiles for the control of fugitive dust, water erosion, water penetration and spontaneous firing.** Parks, C.F. (Dow Chemical USA, Tulsa, OK); Guzek, J. Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

For more than ten years, fugitive dust and water erosion of coal stockpiles have been controlled through the application of chemical crusting. During this time, a growing technology has developed. This paper reviews briefly this technology and discusses recent tests conducted by The Procter and Gamble Paper Products Company, Green Bay, Wisconsin. These tests provided specific data showing that the surface moisture of stockpiles, as well as the tendency to fire, can be controlled by properly designing the piles and applying chemical crusting agents. Experience over the years has shown that at least three major factors enter into the chemical crusting of stockpiles: pile preparation, use of a designed crusting agent, and efficient application. The pile should be compacted to assure a competent base for the crust. The sides of the pile preferably should have at least a 2:1 slope. It is possible to design the crusting agent as well as its application parameters. The basic requirements for the crusting material are described.

32940 (EPRI-WS—79-236, pp 13.1-13.12) **Central station dust control for coal handling equipment.** O'Brien, R.E. (American Air Filter Co., Inc., Louisville, KY). Aug 1981. NTIS, PC A99/MF A01. Order Number DE81904230.

From Coal and ash-handling systems reliability conference and workshop; St Louis, MO, USA (27 Oct 1980).

The areas requiring dust collection are those points of movement from the time the coal arrives at the plant until it is burned. There are four major categories: unloading, conveying, preparation, and storage. In many systems today at major utilities, fugitive dust captured in what were previously considered nuisance collectors now return as much as one to three 100-car trains of usable coal per year. Wet collectors have a fractional efficiency characteristic, that is, their efficiency varies directly with the size of the particle being collected. A comparison of a wet collector at 6" W.G., which is the high side of what the industry considers a low energy unit, and a fabric collector on coal dust would give the fabric a slight edge inasmuch as the size of the particle is less of a concern with fabric. Both methods should be considered. Today, however, industry-wide the fabric units (because of their ability to return usable high BTU product back to the system) have gained an ever-increasing share of the market over wet collectors and suppression systems.

32941 **Investigation of novel coal-preparation techniques.** Knight, R.A.; Onischak, M.; Zabransky, R.F.; Babu, S.P. Chicago, IL; Institute of Gas Technology (1981). 24p. (CONF-810814—8).

From 91. national meeting of the American Institute of Chemical Engineers; Detroit, MI, USA (16 Aug 1981).

Three novel coal preparation techniques were investigated. These included wet size-reduction of coal (i.e., in the presence of water) in a high-throughput crusher, and treatment of caking coals by two methods: water-submerged partial oxidation and partial solvent extraction with process-derived solvents at supercritical fluid conditions. A decrease in fines generation was found in the wet size-reduction studies with hard coals. This technique may be advantageous where water slurry handling systems are used to prepare and deliver coals from the mine to the gasifier. The agglomeration tendency of caking coals was reduced by a wet partial-oxidation treatment in a three-phase fluidized bed at 555 K and 6.89 MPa, and also by partial solvent extraction treatments with benzene, toluene, and benzene/phenol mixtures at 644 K and 7.00 MPa.

32942 **Peat dewatering: solvent extraction.** Paganessi, J.E.; Mensinger, M.C.; Tsaros, C.L.; Arora, J. Chicago, IL; Institute of Gas Technology (1981). 14p. (CONF-8104106—3).

From 3. technical contractors' conference on peat; Bethesda, MD, USA (29 Apr 1981).

The objective of this program is to determine the preliminary technical and economic feasibility of using IGT's solvent-ex-

traction process for the dewatering of peat. Parallel objectives of the program are to: identify organic solvents that can be readily used to dewater raw peat by IGT's solvent-extraction process; design, construct, and operate bench-scale equipment for testing the most promising solvents; and estimate the preliminary economics of the process for a commerical-scale peat dewatering plant using a selective solvent. The results indicate that: solvent-extraction dewatering can remove up to 90% of the water in peat; and diethyl ketone (DEK) and benzene appear to dewater peat better than the other solvents tested. A preliminary economic evaluation of solvent-extraction dewatering of peat with DEK shows that the cost of this type of dewatering method is not currently competitive with other peat dewatering methods. (DWC)

## 0140 Combustion

*REFER ALSO TO CITATION(S) 32805, 32837, 32859, 32861, 33088, 33265, 33507, 33660, 33663*

**32943 Improved particle trajectory calculations through turbomachinery affected by coal ash particles.** Beacher, B.; Tabakoff, W.; Hamed, A. (Univ of Cincinnati, Ohio). *American Society of Mechanical Engineers, [Paper] ;* No. 81-GT-53, vp(1981).

Trajectories of small coal ash particles encountered in coal-fired gas turbines are calculated with an improved computer analysis currently under development. The analysis uses an improved numerical grid and mathematical spline-fitting techniques to account for three-dimensional gradients in the flow field and blade geometry. The greater accuracy thus achieved in flow field definition improves the trajectory calculations over previous two-dimensional models by allowing the small particles to react to radial variations in the flow properties. A greater accuracy thus achieved in the geometry definition permits particle rebounding in a direction perpendicular to the blade and flow path surfaces rather than in a two-dimensional plane. 6 refs.

**32944 (DOE/ET/10593—T2) Fundamentals of nitric oxide formation in fossil-fuel combustion. Progress report, 29 September-28 December 1980.** Houser, T.; McCarville, M.E. (Western Michigan Univ., Kalamazoo (USA). Dept. of Chemistry). Aug 1981. Contract AC21-76ET10593. 19p. (FE—2018-19). NTIS, PC A02/MF A01. Order Number DE81030329.

The rate and products of oxidation of HCN and the influence of additives, benzene, cyclohexane, toluene, acetylene and CO, on the rate and products were extensively studied during this period. The rate was determined in the temperature range of 750 to 825 C and with concentration ranges of .25 to 2 mole % HCN and 1.75 to 7 mole % oxygen. The only significant oxidation products in the absence of additives were $CO_2$, $H_2O$ and $N_2$. The best rate equation to describe the data was rate = k (HCN)/sup 5/4/($O_2$)/sup 1/2/ and the temperature dependence of the rate constant was given by $k = 10^{22\ 5+-5} \exp(-48990 +- 1260/T)$ (1/mole)/sup 3/4/$sec^{-1}$. The complex order indicates a complex chain mechanism is operating, however the activation energy appears too large for a chain or surface mechanism. Benzene did increase the rate of HCN consumption at low equivalance ratios, but at a ratio of about .85 the extent of consumption of all reactants decreased. The result was that HCN consumption dropped drastically and benzene consumption was reduced a small amount even at higher oxygen concentrations in the reactor. Clearly, a species is being produced which inhibits the reaction. No change in products was observed. Cyclohexane and toluene, when added, had about the same influence on the oxidation as did benzene, whereas added water had no influence on the HCN consumption. The addition of either acetylene or CO increased the consumption of HCN to nearly 100%. In addition, both of these promoted the formation of NO. The results produced by these additives cannot be explained on the basis of thermal effects. It appears that CO and acetylene can produce an intermediate during oxidation that does not form when benzene oxidizes.

**32945 (DOE/PC/30295—3) Kinetics of NO/sub x/ formation during early stages of pulversized-coal combustion. Third quarterly report, 4 April 1981-30 June 1981.** Krill, W.V.; Chu, E.K.; Snow, G.C.; Pessagno, S.; Tong, H. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.). 31 Jul 1981. Contract AC22-80PC30295. 54p. NTIS, PC A04/MF A01. Order Number DE81029071.

Program results for the third quarter of the Department of Energy Contract DE-AC2280PC30295, Kinetics of NO/sub x/ Formation During Early Stages of Pulverized Coal Combustion, are reported. The well-stirred nature of the reactor gas phase region and coal transport air have been verified in cold flow and combustion tests. A single pass trajectory of coal particles through the stirred region has also been achieved. Preliminary thermal NO/sub x/ formation characteristics of the gas phase and the reactor temperature environment have been measured for use with the kinetic model. Review of existing modeling techniques for particle devolatilization and oxidation processes and for gas phase kinetics has been completed, and a preliminary kinetic model program has been made operational.

**32946 (DOE/PC/30301—3) CaO interactions in the staged combustion of coal. Third quarterly technical progress report, April 1, 1981-June 30, 1981.** Levy, A.; Merryman, E.L. (Battelle Columbus Labs., OH (USA)). 30 Jul 1981. Contract AC22-80PC30301. 29p. NTIS, PC A03/MF A01. Order Number DE81027490.

The study of the reaction of CaO with $FeS_2$ was completed. The reaction was studied in the temperature range from 750 to 1100° and at Ca/S mole ratios of 0.5, 1.0, and 3.0. The extent of reaction was examined at time intervals of 1 to 130 seconds and at longer time intervals of 5 to 15 minutes. Data from the shorter time intervals suggest a zero order reaction based on sample weight loss, and yield an apparent activation energy of 14.3 kcal/mole. The overall chemistry indicates that the CaO is reacting with sulfur vapors from the pyrolysis of $FeS_2$ to form CaS and SO/sub x/, the ultimate sulfur oxide being $SO_2$. Solid-solid reactions to form FeO or Fe/sub x/O/sub y/ are not apparent. It is apparent, however, that in the absence of oxygen, 50 percent or more of the sulfur in the sample can be retained in the solids as pyrrhotites, Fe/sub x/S/sub y/. Another 10 to 25% of the sulfur may be retained as CaS at the higher temperatures and higher Ca/S ratios. The addition of charcoal to the CaO-pyrite mixture enhanced the retention of sulfur in the solid. Exposing the solid mixtures to $N_2$-$H_2O$, CO-Ar or $CO_2$-Ar gas streams had little effect on sulfur retention. Adding $O_2$ to the gas significantly increased $SO_2$ formation. 5 figures, 3 tables.

**32947 (DOE/PC/30307—3) Effects of components of synfuels on soot formation. Quarterly technical progress report Number 3, April 1-June 30, 1981.** Haebig, J.E.; Goldberg, P.M. (Gulf Science and Technology Co., Pittsburgh, PA (USA). Chemical and Minerals Div.). Aug 1981. Contract AC22-80PC30307. 16p. NTIS, PC A02/MF A01. Order Number DE81027961.

The objective of this project is to obtain information about the relationships between the rate and amount of soot formation in the combustion of coal-derived synfuels and the chemical composition and molecular constituents of those fuels. Simple bench-scale premixed and diffusion burners will be used at pressures between one and ten atmospheres to observe soot formation from fuel samples varying in their boiling range and contents of aromatic and heteroaromatic compounds. During this reporting period, the Gulf-sponsored development of the experimental system was completed for its use in one atmosphere pressure experiments in this DOE contract. Preparatory acomplishments included assembly of the flow control panel for seven gas streams, initial use of the optical components for laser light scattering, and fabrication and installation of the burner and pressure vessel for it. In the DOE contract activities, Task 1 was completed, the combustion literature was surveyed and used to identify needed features of the experiments to be done, and data on the properties and composition of coal liquids were collected for planning of the slate of coal liquids components to be tested.

**32948 (ORNL/TM—7724) Coal and limestone feed testing for atmospheric fluidized bed combustion.** Daw, C.S.; Thomas, J.F.; Lackey, M.E. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 78p. NTIS, PC A05/MF A01. Order Number DE81030629.

Pneumatic conveying tests of coal and coal-limestone mixtures were performed on a conveying system designed to represent the branch feed lines in the TVA 20 MW(e) atmospheric fluidized bed combustor pilot plant. Test conditions were chosen to cover the operating ranges anticipated for the pilot plant. These tests have led to a basic understanding of the design and operating problems associated with coal surface moisture, air velocity, fines content, solids loading, and limestone to coal ratio. Coal surface moisture was found to be the most important parameter affecting handling properties. Above a critical level of about 6%, surface moisture caused severe compaction problems in the feed hopper and impact plugging in the conveyor line. When surface moisture was less than 6%, conveyor line plugging resulted only from saltation and filling. Limestone addition reduced the problems associated with wet coal. Coal with up to 17% surface moisture was successfully conveyed by adding dry limestone at a level of 0.5 kg limestone per kg of wet coal. Practical operating limits for saltation and surge flow were also developed. In general, it is recommended that superficial air velocity be kept greater than 16.8 m/s (55 ft/s) everywhere in the conveyor line during coal-limestone flow. When saltation or plugging do not occur, frictional pressure drop is only a function of the solids loading and the air flow conditions. A general correlation was developed to describe this relationship.

**32949 Tennessee Valley Authority plans to demonstrate FBC steam power generation from coal.** *Materials and Components in Fossil Energy Applications ;* No. 23, 4-7(1 Aug 1981).

The Tennessee Valley Authority (TVA) initiated engineering studies on atmospheric fluidized-bed combustion (AFBC) for electric power generation in September 1976. It was recognized that a pilot plant was needed to provide detailed design data in areas such as coal feeding, control schemes for load following, emission controls, and others. In September 1979, TVA contracted with Babcock and Wilcox Company and with Stone and Webster to build a 20-MW AFBC pilot plant at the Shawnee Steam Plant near Paducah, Kentucky. Plant design work is now approximately 90% complete and site work started in April 1980. It is planned to start testing in the summer of 1982. In July 1980, TVA and the Electric Power Research Institute (EPRI) agreed to share the cost of operating the AFBC pilot plant. That agreement requires the development of a detailed test plan to cover the contract period. This test plan is currently being developed by TVA, EPRI, Radian, Jaycor, and others and will be reviewed by some of the major boiler manufacturers and DOE. The test plan will cover the operation, testing, and analysis of the pilot plant performance. Plans call for alternate fuels such as Western coals and lignites to be tested in later test campaigns. TVA personnel will operate the plant and perform most of the testing and data reduction. A 200-MW central station AFBC demonstration plant is also being planned and presently projected for completion in 1988.

**32950 Design and preliminary results of a fuel flexible industrial gas turbine combustor.** Novick, A.S.; Troth, D.L.; Yacobucci, H.G. (GM, Indianapolis, Indiana). *American Society of Mechanical Engineers, [Paper] ;* No. 81-GT-108, vp(1981).

The work described in this paper is a part of the DOE/ LeRc "Advanced Conversion Technology Project". The emphasis in this paper is the fuel flexible combustor technology developed under the "Low NO/sub x/ Heavy Fuel Combustor Concept Program" for application to the Detroit Diesel Allison 570-K industrial gas turbine engine. The technology, to achieve emission goals, emphasizes dry NO/sub x/ reduction methods. Due to the high levels of fuel bound nitrogen (FBN), control of NO/sub x/ can be effected through a staged combustor with a rich initial combustion zone. A rich quench/lean variable geometry combustor is the technology presented to achieve low NO/sub x/ from alternate fuels containing FBN. The results focus on emissions and durability for fuel flexible operation. 13 refs.

**32951 Low NO/sub x/ combustion systems for burning heavy residual fuels and high-fuel-bound nitrogen fuels.** White, D.J.; Batakis, A.; LeCren, R.T.; Yacobucci, H.G. (Sol Turbine Int, San Diego, Calif). *American Society of Mechanical Engineers, [Paper] ;* No. 81-GT-109, vp(1981).

The work described in this paper is a part of the DOE/ LeRC. Environmentally acceptable operation with minimally processed petroleum based heavy residual and coal derived synthetic fuels requires advanced combustor technology. Novel combustor concepts were designed for dry reduction of thermal NO/sub x/, control of NO/sub x/ from fuels containing high levels of organic nitrogen, and control of smoke from low hydrogen content fuels. These combustor concepts were tested by burning a wide variety of fuels including a middle distillate, a petroleum based heavy residual, a coal derived synthetic, and various ratios of blends of these fuels. 1 ref.

**32952 Controlled combustion of a varying low-btu coal-derived gas.** Carpenter, L.K.; Nakaishi, C.V.; Bird, J.D.; Loth, J.L. *American Society of Mechanical Engineers, [Paper] ;* No. 81-GT-134, vp(1981).

The Morgantown Energy Technology Center is participating in a Ceramics Corrosion/Erosion Materials Study. The objective is to create a technology base for ceramic materials for use in stationary gas power turbines operating in a high-temperature environment produced by combustion of low-caloric, coal-derived gas. Dynamic and static test facilities are designed and installed which have the capability to burn a varying low-caloric, coal-derived fuel gas in a controlled manner. This paper gives a description of METC's design philosophies in developing these combustion test facilities. 11 refs.

**32953 Evaluation of concepts for controlling exhaust emissions from minimally processed petroleum and synthetic fuels.** Russell, P.L.; Beal, G.W.; Sederquist, R.A.; Schultz, D. *American Society of Mechanical Engineers, [Paper] ;* No. 81-GT-157, vp(1981).

This paper describes an exploratory development effort to identify, evaluate and demonstrate techniques for controlling emissions of NOx and smoke from combustors of stationary gas turbine engines. Preliminary results indicate rich primary zone staged combustion provides environmentally acceptable operation with residual and/or synthetic coal derived liquid fuels. 3 refs.

**32954 Hydration enhanced sulfation of limestone and dolomite in the fluidized-bed combustion of coal.** Shearer, J.A.; Smith, G.W.; Myles, K.M.; Johnson, I. (Argonne Natl Lab, Ill). *Proceedings of the Air Pollution Control Association ;* **1**: No. 80-6.5, vp(1980). (CONF-800608—).

From Air Pollution Control Association annual meeting; Montreal, Canada (Jun 1980).

The work reported details studies of limestones and dolomites reacted in laboratory furnaces as well as a large scale test in the ANL 15-cm-ID atmospheric-pressure fluidized bed combustor (AFBC). The AFBC results indicate that the hydration process can increase the once-through utilization of approximately 20% to nearly 80%. 9 refs.

## 0150 Marketing And Economics

*REFER ALSO TO CITATION(S) 32848, 32880, 32881, 32883, 32885, 32891, 32892, 32906, 32942, 32976*

**32955** (ANL/LRP-TM—20, pp 55-62) **Zoning lands unsuitable for surface coal mining: an economic review.** Hatfield, M.A.; Balzer, L. (Utah International, Inc., San Francisco, CA). 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

Land use planning conflicts in the development of mineral resources are discussed in this article. The Surface Mining Control and Reclamation Act of 1977 establishes a process to identify land unsuitable for coal mining. The planning process employed by the Office of Surface Mining to evaluate the petition for developing the

Alton Coal Field in Utah is presented and the process is evaluated. (DMC)

32956 (ANL/LRP-TM—20, pp 67-74) **Performance bonding impact upon the cost of reclamation of coal mines lands.** Randolph, R.H. (Office of Surface Mining, Indianapolis, IN). 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

P.L. 95-87 stipulates that after a surface coal mining permit application has been approved, but before such a permit is issued, the operator shall file with the regulatory authority a bond covering the costs of reclamation of the permit area. Since reclamation costs will vary from state to state, and from area to area within a state because of geography, geology, topography, land use, chemical differences in overburden or by a combination of these factors, the cost of bonding will likewise vary. This paper will present kinds of bonding available to the operator, the costs thereof, length of bonding, (short-term vs long-term) and the economic impact upon reclamation and product cost, as well as the impact on the small, medium, and large operator. Performance Bonding, a requirement of Section (509) - P.L. 95-87, has been revised through public hearings but, the surety companies have been less than enthusiastic about the non-cancellable, long-term provisions. A newly added bonding option, a combination of short-term bonding combined with escrow bonding in most cases is probably the best option available for large, medium, and small operators, to result in minimum economic impact.

32957 (ANL/LRP-TM—20, pp 79-91) **Reclamation in the big sky.** Julian, E.L. (Tennessee Valley Authority, Chattanooga). 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

This paper examines benefits and costs of reclamation of surface-mined coal land in the western United States through the use of a mine-site study; the Big Sky Mine in Montana is the mine used. Benefits whose monetary values are estimated include recreation, hydrology, agriculture, and aesthetics. Atmospheric and psychological benefits are also considered. Several estimates of cost are used. Benefits and costs are compared by present value methodology. Benefit-cost ratios are presented, and sensitivity analysis is performed. Although psychological benefits could not be estimated, the annual value of these benefits that would be required to make benefits equal to costs is calculated. Relevance of benefits and costs at the Big Sky Mine to other western areas is considered.

32958 (ANL/LRP-TM—20, pp 105-108) **Comparison of reclamation costs: West and Midwest.** Bernard, J.R. (British Columbia Ministry of Lands, Victoria, Canada). 1980. NTIS, PC A12/MF A01. Order Number DE81029992.

From Conference on the economics of mined-land reclamation; Chicago, IL, USA (1 Sep 1981).

So seldom do reclamation cost figures emerge from actual mining operations, that recent regulatory economic research has sought to identify baseline values for reclamation cost. Data presented here are meant to contribute to the information pool available to researchers involved in cost-benefit of regulation. The results of 1980-1981 reclamation cost studies on two research mine areas; one in the Midwest, and one in the Western coal region of the United States are described here. Reclamation activities common to both mines have similar cost levels, e.g., planning and permitting, drainage control, monitoring, earth moving. In either case, the extraodinary expense of reclamation ($30,000/ha. to $60,000/ha.) in these mines provides a suitable incentive to conduct thorough and very far sighted analysis of the benefits of such activity.

32959 **Economics of synfuel and gasification systems.** Hahn, O.J. Lexington, KY; University of Kentucky (1981). 32p. (CONF-8104107—9).

From 12. annual Kentucky industrial coal conference; Lexington, KY, USA (29 Apr 1981).

The performance characteristics of several gasification systems are discussed. Cost estimates of various synthetic fuels are presented. The lowest cost synthetic fuel is significantly above the current natural gas price of about $2.75/MMBtu and about equivalent to present oil prices at the plant gate. Gas prices for the Welman-Galusha gasifier would have to be increased significantly if the plant ran on two shifts only or if the gasifiers were not fully loaded. For industrial application the lowest cost fuel is probably the direct use of low sulfur coal with some post combustion pollution control. This is followed by the atmospheric fluidized bed combustor. Coal/oil mixtures and solvent refined coal liquids (SRC I or SRC II) are the next options. High Btu gas from a large coal gasification plant will be more competitive for industrial use. Large industrial uses in the range of 1000 tons of coal a day may find reduced costs with an entrained coal conversion unit such as a Texaco or the Saarberg-Otto Gasifiers. However, before 1985 when the gas price decontrol has been felt, it is unlikely that low Btu gas, medium Btu gas and methanol will be an economical choice for industrial users.

### 0160 Health And Safety

*REFER ALSO TO CITATION(S) 33912*

32960 **(LMF—85) Low-Btu-gasifier emissions toxicology. Status report, December 1980.** Henderson, R.F. (ed.). (Inhalation Toxicology Research Inst., Albuquerque, NM (USA); Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76EV01013. 67p. NTIS, PC A04/MF A01. Order Number DE81031000.

A cooperative comprehensive multidisciplinary research effort between the Lovelace Inhalation Toxicology Research Institute (ITRI) and the Morgantown Energy Technology Center (METC) has been addressing basic human health risks associated with low Btu coal gasification. The major goal of this research effort is to assess inhalation hazards to plant workers and the general population that may be associated with low Btu coal gasification. To achieve this goal, it is necessary to characterize the potential toxicants in liquid and solid process and waste streams. To these ends, the experimental low Btu gasifier at METC has been sampled to determine aerosol components in gaseous process streams and to assess potential toxicants in liquid and solid effluent streams. Results and tentative conclusions are presented.

## 02 PETROLEUM

### 0201 Reserves

*REFER ALSO TO CITATION(S) 33386*

### 0202 Geology And Exploration

32961 (EPRI-WS—79-182, pp 3.11.1-3.11.23) **Advanced logging techniques.** Finklea, E.E. (Schlumberger-Doll Research, Ridgefield, CT). Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

A discussion is presented on measuring instruments, usually referred to as logging tools, that are lowered into the well at the end of an armored electrical cable which can be up to 30,000 feet long. Signals from the downhole tools are transmitted via the cable to the logging truck where they are recorded optically on a strip of photographic film or digitally on magnetic tape for computer analysis. The measurements taken appear in the form of a continuous graph or log scaled to depth of formation characteristics such as electrical conductivity, spontaneous potential, nuclear properties, sound travel time, density, temperature, and others. These measurements permit engineers to deduce rock and formation fluid properties. The downhole instruments used in modern well logging are complex. For example, an induction or sonic logging cartridge contains several hundred electric and electronic components which must be packaged to fit into a pressure housing having an inside diameter of only 2-3/4 inches (6-7/8 cm) since the tools must be small enough to move freely in the wellbore. Recognizing the advantage of an integrated system of surface instrumentation built

around a computer, a few years ago a complete system for acquiring, storing, processing, and presenting well log data was introduced in the field. A few of the many applications for modern logging techniques are presented.

**32962 Mechanism of the formation of diapiric structural traps in Dongying depression, Shandong.** Wang, X.; Fei, Q.; Zhang, J. (Wuhan Coll. of Geology, China). *Acta Petrolei Sinica ;* **2**: No. 3, 13-22(Jul 1981). (In Chinese).

Diapiric structure is an important type of oil and gas traps. Whether such traps actually exist in east China and how is the mechanism of their formation is a subject of much dispute. Based on the study of the oil-bearing structural features in the deep and shallow levels in the Dongying depression in east China, the authors present the following observations. Diapiric structures of plastic salt and gypsum and plastic soft clay of different origin are widespread in the Dongying depression. The plastic rocks that form the core of the diapiric structures are ridge-like, arranged in echelon along the regional trend. Three such diapiric structural zones trending NEE have been noticed. In the various diapiric structures, there are graben-like fault systems of varying complexities developed on the crest of the structures, typical of diapirism and indicative of the occurrence of uplifting of plastic rocks. The distribution of diapiric structures in the Dongying depression is controlled by the broom-like tectonic system in the Bohai Bay. They are the product of both gravity and horizontal torsional stress. The basic features of the diapiric structures in the Dongying depression are characteristic of the oil basins in east China, where plastic rocks of salt, gypsum and clay are well developed in the upper part of Eocene and the lower part of Oligocene and their deformation has a great influence on the evolution of Cenozoic structures and the formation of oil and gas traps there.

**32963 Occurrence of the oil pool in the metamorphosed basement in Yaerxia in the western part of the Jiuquan Basin.** Xie, G. *Acta Petrolei Sinica ;* **2**: No. 3, 23-30(Jul 1981). (In Chinese).

The oil pool in the metamorphosed basement in Yaerxia was discovered in 1959. Its reservoir rock is composed of an interbed of slightly metamorphosed greyish-green and purple sandstone and arenaceous shale of Silurian. Oil accumulations lie in the neighborhood of faults or at the intersection of faults and on the anticlinal axis where fractures are well developed. The overburden consists of sections in Silurian with no fractures and mudstones of Cretaceous and Tertiary. Crude oil comes from the lower Xinmingbao group of Cretaceous in the Qingsi depression, with properties similar to that from the other pools in the western part of the Jiuquan basin-paraffin-naphthenic hydrocarbons. On the plane, the oil pool is distributed like a sheet, and in the vertical section it is divided into multiple zones. Simultaneous with the study of the area covered by the oil pool, efforts should be directed to find out the lower depth limit of the pool so as to discover more reserve.

**32964 Source of oil for the western part of the Tarimu Basin.** Lu, M.G. (Scientific Research Inst. of Petroleum Exploration and Development, Beijing, China). *Acta Petrolei Sinica ;* **2**: No. 3, 31-36(Jul 1981). (In Chinese).

There are five suites of source rocks in the western part of the Tarimu Basin, the Jurassic being a suite of practical value, with abundant organic materials of very good properties and with appropriate maturity. The Cretaceous-Lower Tertiary series is very prospective, though the conditions for oil generation along the basin margin are not so favourable. It is marine deposit controlled by faults. Source rocks of considerable thickness are supposed to exist in the Kashi-Yecheng and Awati-Luntai depressions. Crude oils are classified into four types according to their properties. The oils from North Bancheng and Wuqia are characteristic of continental origin, with spectra of isoprenoids similar to those for the Jurassic source rocks. They are originated from the Jurassic source rocks. The oils from Kuche and South Yecheng have a low pristane/phytane ratio, their vanadium/nickel ratio is greater than l; and with the discovery of two pieces of algae fossil, they are identified to be of marine origin. The carbon isotopes from the crude are quite like those in the Cretaceous-Lower Tertiary source rocks, so they are most probably from the Cretaceous-Lower Tertiary source rocks.

**32965 Occurrence of oil in the complex fault-blocks in the Jiyang sag.** Wang, P. *Acta Petrolei Sinica ;* **2**: No. 3, 37-43(Jul 1981). (In Chinese).

There are many complex fault-block oil pools in the Jiyang sag in the northern part of Shandong Province. They resulted from intensive block-faulting of inherited nature during the main period of oil accumulations which caused remigration of oil and gas that finally formed into pools. Evidently, these pools are controlled by fault blocks which are separated from each other by major faults of inherited nature. Each fault block may contain several minor blocks with similar reservoir characteristics, but wide differences are apparent between the different fault blocks.

**32966 Discussions on the main periods and threshold temperature (depth) of oilgeneration in the Songliao basin.** Fang, Z. (Petroleu College, Daqing, China). *Acta Petrolei Sinica ;* **2**: No. 3, 103-106(Jul 1981). (In Chinese).

In studying the threshold temperature (depth) of oil generation of the source rocks in Qijia-Gulong and Sanzhao depressions in the Songliao Basin with J. Cannan time-temperature formula, a correction factor of 18°C should be applied to negate the error caused by the geothermal differences between the ancient and recent ages. It has been found that oil generation in the Qijia-Gulong depression started at the time of deposition of Sifangtai formation in late Cretaceous, earlier than that in Sanzhao depression which began at the time of deposition of Mingshui formation in late Cretaceous. This is the reason why oil of Daqing field has its origin from the former, and few oil pools occur in the latter.

## 0203 Drilling And Production

*REFER ALSO TO CITATION(S) 33230, 33664*

**32967 (DOE/ET/10145—72) Relational methodology for integrating and analyzing field test and research data describing enhanced oil recovery.** Bavinger, B.A.; Callaway, S.; Goodbread, D.T.; Gumnick, J.L. (Gulf Universities Research Consortium, Bellaire, TX (USA)). Oct 1981. Contract AC01-76ET10145. 154p. NTIS, PC A08/MF A01. Order Number DE81030441.

This report demonstrates the application of concepts of relational analysis for the integration of two experimental data bases created by Gulf Universities Research Consortium: the Enhanced Oil Recovery Field Test Data Base; and the Enhanced Oil Recovery Research Data Base.

**32968 (DOE/ET/12038—T3) Improved polymers for enhanced oil recovery: synthesis and rheology. Third annual report, October 1979-September 1980.** McCormick, C.L.; Hester, R.D.; Neidlinger, H.H.; Wildman, G.C. (University of Southern Mississippi, Hattiesburg (USA). Dept. of Polymer Science). Apr 1981. Contract AS05-77ET12038. 300p. NTIS, PC A13/MF A01. Order Number DE81030194.

This document reports on the synthesis, characterization, and rheological studies of random- and graft-copolymers which are used as models for mobility control agents in enhanced oil recovery. These studies include macromolecular syntheses of model polymers, dilute solution viscosity studies, aqueous-size exclusion chromatography, and laser light scattering.

**32969 (DOE/ET/12057—8) Bodcau in situ combustion project. Fourth annual report, September 1, 1979-February 28, 1981.** Hardin, G. (Cities Service Co., Jackson, MS (USA)). Jul 1981. Contract AC03-76ET12057. 101p. NTIS, PC A06/MF A01. Order Number DE81025797.

Objective is to demonstrate the technical efficiency and economics of a commercial scale in-situ combustion project in a shallow heavy oil reservoir. Five elongated inverted nine-spot patterns were developed for this demonstration on Cities Service Company's Bodcau Fee B lease in the Bellevue Field, Bossier Parish, Louisiana. The five patterns comprising the demonstration project enclose 19 productive acres and consist of thirty-eight producing, five injection and five observation wells. This report briefly reviews the history of the project with emphasis on operations from September 1979 through February 1981. Sections on the air system explosion

in February 1980 and the results from an evaluation well drilling program in pattern 15 are highlights.

**32970 (EPRI-EM—1996) Cogeneration potential: enhanced oil recovery. Final report.** Rodden, R.M.; Boyen, J.L. (RMR Associates, Palo Alto, CA (USA)). Aug 1981. 69p. NTIS, PC A04/MF A01. Order Number DE81904202.

The purpose of this project was to perform a preliminary evaluation of the potential in the United States for generating electric power in connection with producing steam for the enhanced recovery of oil. The analysis identified the size and location of the heavy oil resource base and developed estimates of oil recovery potential. Using these data, estimates were made of electric power capacity that could result if cogeneration were used to supply the necessary steam for thermal recovery. Incentives and obstacles to the use of cogeneration for thermally enhanced oil recovery are identified and discussed in the report. The attitudes of the utilities companies and the petroleum producers toward the possible use of cogeneration for thermal oil recovery are also identified and discussed. The report presents preliminary design information on cogeneration systems that would be suitable for thermally enhanced recovery. General information was presented on three representative systems as follows: semitransportable gas turbine system, semitransportable steam turbine system, and central plant multiple gas turbine system. Some of the environmental problems associated with the use of cogeneration for enhanced oil recovery are identified and discussed.

**32971 (SAND—81-0043) Project DEEP STEAM: fourth meeting of the technical advisory panel, Albuquerque, NM, November 1980.** Fox, R.L.; Donaldson, A.B.; Eisenhawer, S.W.; Hart, C.M.; Johnson, D.R.; Mulac, A.J.; Wayland, J.R.; Weirick, L.J. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1981. Contract AC04-76DP00789. 104p. NTIS, PC A06/MF A01. Order Number DE81029457.

The Fourth Project DEEP STEAM Technical Advisory Panel Meeting was held on 5 and 6 November 1980 in Albuquerque, New Mexico, to review the status of project DEEP STEAM. This Proceedings, following the order of the meeting, is divided into five main sections: the injection string modification program, the downhole steam generator program, supporting activities, field testing, and the Advisory Panel recommendations and discussion. Each of the 17 presentations is summarized, and a final Discussion section has been added, when needed, for inclusion of comments and replies related to specific presentations. Finally, the Advisory Panel recommendations and the ensuing discussion are summarized in the closing section.

**32972 Field pilot test to demonstrate the whole process of water flooding in the Daqing oil field.** Tang, Z. (Daqing Oil Field, China). *Acta Petrolei Sinica ;* **2**: No. 3, 45-53(Jul 1981). (In Chinese).

In order to get acquainted with the characteristics and changes of production by waterflooding and to make predictions about its sweep efficiency, a field pilot test was conducted in 1965 in the Daqing oil field on a close-spaced well pattern. Results of the test have been proved to be reliable by numerical simulation and core analysis. Lower recovery-bbl/psi drop when the water cut is less than 60%; a steady output may be maintained if the reduction of the difference between bottom hole pressure and saturation pressure is gradual. Flowing production is suitable when the water cut is less than 60 ~ 70%; when water cut exceeds this limit, other means of production should be chosen on the basis of techno-economic analysis. The recovery factor by water drive in the Daqing oil field is 40%, the increase of water cut is rather rapid and the period of production with water cut is quite long.

**32973 Rational rate of recovery and well density in the development of carbonate pools in Renqiu.** Yin, D.; Sun, Y. *Acta Petrolei Sinica ;* **2**: No. 3, 55-62(Jul 1981). (In Chinese).

Based on the analysis of production statistics from the Renqiu oil field and the numerical simulation of water cone, a comparative study is made of the results of development with different rates of recovery and different well density. Results show that the rational rate of recovery for the Renqiu oil field should be less than 2%. Given a specific rate of recovery, different well density for the different stages of development will give different results. For the Renqiu oil field, the rational well density is 0.75 to 1 well per square kilometer. Starting from the geological features in Renqiu and after comparing the results of exploitation of wells with different height of oil columns, it is proposed that the wells should be located in areas where the height of oil column is equal to or greater than the average thickness of the reservoir.

**32974 Study of the unsteady-state flow of slightly compressible fluid in naturally fractured reservoirs and its application in well test analysis.** Zhu, Y.; Zhang, J.; Le, G.; Shi, J. *Acta Petrolei Sinica ;* **2**: No. 3, 63-72(Jul 1981). (In Chinese).

This paper deals with the unsteady-state flow of slightly compressible fluid in naturally fractured reservoirs, and after analysing factors affecting the flow behavior, gives some important characteristics pertaining to such a state. Two methods of analysing well test data for the naturally fractured reservoir have been proposed in the latter part of the paper. They have been used in the North China oil field with satisfactory results.

**32975 Technology of strengthening the power transmission chains for oilfield drilling rigs.** Liu, S.; Meng, B.; Chen, Z. (Dalong Machinery Workshop, Shanghai, China). *Acta Petrolei Sinica ;* **2**: No. 3, 73-82(Jul 1981). (In Chinese).

Several technological processes for improving the power transmission chain's performance and prolonging its operating life are discussed, including carbonitriding of pins and bushings, heat treating of rollers to low-carbon martensite and coldextruding of link plate holes, based on the service conditions of the driving chains of the oil field rigs. Causes of the major failures of the chains are analysed in conjunction with the materials generally used in China in making the chains. Noticeable results have been obtained not only in preventing early failure or wearing of open driving chains but also in increasing the fatigue strength of encased driving chains.

**32976 Economics of enhanced oil recovery and its position relative to synfuels.** Perry, C.W. (US DOE). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper ;* 111-120(Feb 1981). (CONF-810207—).

The options of enhanced oil recovery, coal syncrude, and shale syncrude are compared by approximately equivalent economics. The physical constraints for the major enhanced oil recovery processes are described, followed by new estimates of cost. The range for all three options in terms of light syncrude equivalent are /22 to $40 per barrel in 1980 dollars.

## 0204 Processing

*REFER ALSO TO CITATION(S) 33322*

**32977 Heat-supply system for a fluidized-bed reactor featuring an endothermic reaction.** Kono, H.O.; Ninomiya, K. Chicago, IL; Institute of Gas Technology (1981). 9p. (CONF-810804—16).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

For a fluidized-bed reactor in which a strong endothermic catalytic reaction takes place (for example, dehydrogenation of propane or butane) it is necessary to supply a large amount of the heat of reaction at a temperature at which the product compounds do not decompose significantly. A new concept of heat-supply system was proposed, and its characteristics were studied experimentally, employing an apparatus with an inner diameter of 0.3 m and a height of 2 to 6 m. The solids in a transported phase at high temperature (e.g. 890 K) flow in the set of vertical pipes that are immersed in the fluidized catalytic reactor. The circulating particles supply the necessary heat of reaction smoothly to the bed. These vertical heat exchange pipes are the connecting pipes between two solids reservoirs. One reservoir is located above the reactor and the other under the reactor. Particles circulate in large quantities between the two reservoirs. Heat is supplied to this system by feeding a very-high-temperature gas (1473 to 1573 K) to the lower reser-

voir, but the temperature of the heat-supply system remains at an appropriate temperature level because of the heat transfer from the heating system to the reactor. During the experiments the solids flow behavior, particularly the amount of particles circulating in the system, was studied by changing the operational and geometrical parameters and employing different solids. The amount of particle circulation, which is important for transporting a large amount of heat smoothly from the system to the reactor, was found to be 250,000 to 1.2 million $kg/m^2$-h in the riser pipe; and the heat transfer coefficients at the pipe inside surfaces were in the range of 300 to 600 $kcal/m^2$-h-K.

## 0205 Products And By-products

*REFER ALSO TO CITATION(S) 33082*

32978 **Hydrogenation or recovery of acetylene: an economic comparison.** Sohns, D. (Linde Ag, Hoellriegelskreuth, Germany). *Engineering Costs and Production Economics ;* **5**: No. 2, 121-128(Sep 1980).

Higher hydrocarbon prices have affected the profitability of the recovery or hydrogenation of $C_2$-acetylenes from an olefins plant. A review of the economics of these processes therefore seems appropriate. When acetylene production is low and the product has little value, the preferred method is hydrogenation. Furthermore, scattered production makes the marketability problematic. The recovery of acetylene is, however, a really low cost production process. Consequently, the majority of the demand for petrochemical use of acetylene should be satisfied from this source. The main objective of the article is to show the attractiveness of this process.

32979 **Planning an integrated Mexican petrochemical industry.** Trevino, A.A.; Rudd, D.F. (Univ. of Wisconsin, Madison). *Engineering Costs and Production Economics ;* **5**: No. 2, 129-142(Sep 1980).

The production of man-made fibers, synthetic rubber, plastics and many other consumer goods in Mexico has been dependent on imported petrochemicals. Here we analyze four industrial development strategies leading towards an integrated Mexican petrochemical industry. It is shown that a superior policy exists.

## 0207 Marketing And Economics

*REFER ALSO TO CITATION(S) 32976, 33398, 33406, 33407, 33414*

32980 **(DOE/MI/01006—T1-Pt.1) Impact of motor-gasoline price/availability trends on selected minority and disadvantaged populations.** Bird, N.; Hill, J.; Ryavec, M. (Cardinal Management Associates, Inc., Washington, DC (USA); Cardinal Management Associates, Inc., Los Angeles, CA (USA)). Aug 1981. Contract AC01-80MI01006. 96p. NTIS, PC A05/MF A01. Order Number DE81029974.

The objectives of this study are: to determine the gasoline purchasing and consumption patterns of minority and disadvantaged population groups; and to analyze the socio-economic effects of increasing gasoline prices and shortages on minority and disadvantagd population groups. In order to accomplish these major objectives, the following additional objectives had to be accomplished: develop a social and economic profile of each of the subject population groups; and locate and analyze published materials concerning gasoline consumption by minority and disadvantaged groups. The report consists of two parts. Part one contains chapters on the following: introduction to the study of motor vehicle fuel consumption by minority and disadvantaged populations; summary overview of the literature related to the research problems; methodology for the study; findings of the study; and conclusions and recommendations. Part two contains appendices of community case studies and a review of the relevant literature. Case studies were done for the following cities: Atlanta, Georgia; Burlington, Vermont; Greenville, Mississippi; Los Angeles, California; and San Antonio, Texas.

32981 **(DOE/MI/01006—T1-Pt.2) Impact of motor gasoline price/availability trends on selected minority and disadvantaged populations.** (Cardinal Management Associates, Inc., Washington, DC (USA); Cardinal Management Associates, Inc., Los Angeles, CA (USA)). Aug 1981. Contract AC01-80MI01006. 160p. NTIS, PC A08/MF A01. Order Number DE81029980.

The objectives of this study are: to determine the gasoline purchasing and consumption patterns of minority and disadvantaged population groups; and to analyze the socio-economic effects of increasing gasoline prices and shortages on minority and disadvantaged population groups. In order to accomplish these major objectives, the following additional objectives had to be accomplished: develop a social and economic profile of each of the subject population groups; and locate and analyze published materials concerning gasoline consumption by minority and disadvantaged groups. The report consists of two parts. Part one contains chapters on the following: introduction to the study of motor vehicle fuel consumpation by minority and disadvantaged populations; summary overview of the literature related to the research problems; methodology for the study; findings of the study; and conclusions and recommendations. Part two contains appendices of community case studies and a review of the relevant literature. Case studies were done for the following cities: Atlanta, Georgia; Burlington, Vermont; Greenville, Mississippi; Los Angeles, California; and San Antonio, Texas.

32982 **(EPRI-WS—79-182) Workshop proceedings: world oil and natural gas supplies.** Frank, H.G. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA)). Aug 1981. 296p. (CONF-7906218—). NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

This report contains the proceedings of the EPRI Workshop held June 12-13, 1979. A summary of workshop discussions, abstracts of presentations, and papers presented by participants are included. The interrelationship between economics, politics, resources, and technologies that will influence future oil and gas supplies is addressed. Separate abstracts have been prepared for individual papers for inclusion in the Energy Data Base. (DMC)

32983 (EPRI-WS—79-182, pp 3.3.1-3.3.4) **US institutions: the Export-Import Bank.** Blask, J. Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

The historic role of the Export-Import Bank as an institution for financing the economic development of various countries around the world is discussed. In the past, the Export-Import Bank has provided long term loans for energy development to Mexico, Indonesia, and various Latin American countries, as well as taking an active role in providing financial resources for non-oil energy development. The Export-Import Bank was founded in 1934 and has a broad statutory mandate. It is subject to various statutory restraints as well. By its charter, the Bank is directed to aid in financing and facilitating US exports at interest rates and under financial terms that are competitive with those offered by other major trading nations, particularly the OECD countries. An important restraint on Export-Import Bank activities is the budgetary limitation, which in the present fiscal year (1979) provides $3.6 billion for direct lending. The Bank is expected to operate on a self-sustaining basis, with the cost of lending covered by the lending income. It does not have access to funds appropriated by Congress. In addition, the Bank statutes say that activities should supplement and encourage but not compete with private capital, nor should it take measures which could have an adverse impact upon the American economy. Finally, the Bank is constrained against lending in a manner that would aggravate supply shortages in the United States. This constraint arose during the period when the Bank actively supported equipment exports to North Sea oil fields, when it was alleged that drilling equipment was in short supply in the United States. In addition, Congress requires that the credit standard set by the Bank should be such that all transactions must offer a reasonable assurance of repayment, and Congress prohibits activities in most communist countries.

32984 **Energy in America: fifteen views.** Los Angeles, CA; University of Southern California Press (1980). 285p. (CONF-7905197—).

From Conference on energy in America; Los Angeles, CA, USA (May 1979).

Fifteen nationally recognized authorities from academia, industry, research, and government met at the Center for Study of the American Experience to express their veiws on the tradeoff between the supply and the price of energy in the future. Decontrol of gasoline prices, the windfall profits tax, federal subsidy for development of alternative energy sources, and environmental concerns were some of the topics covered. This book contains the texts of their addresses as well as questions and answers at the end of each speech. (DMC)

## 0209 Environmental Aspects

*REFER ALSO TO CITATION(S) 32950, 32953, 33743, 33817*

## 0210 Legislation And Regulation

*REFER ALSO TO CITATION(S) 33403, 33409, 33411, 33412, 33417*

## 0230 Properties

*REFER ALSO TO CITATION(S) 32964*

32985 **(DOE/BETC/PPS—81/4) Heating oils, 1981.** Shelton, E.M. (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). Aug 1981. 44p. NTIS, PC A03/MF A01. Order Number DE81030833.

Properties of 249 heating oils marketed in the United States were submitted for study and compilation under agreement between the Bartlesville Energy Technology Center (BETC) and the American Petroleum Institute (API). The fuels were manufactured by 28 petroleum refining companies in 92 domestic refineries. The data are tabulated according to six grades of fuel and subdivided into five geographic regions in which the fuels are marketed. The six grades of fuels are defined by the American Society for Testing and Materials (ASTM) Specification D396. The five regions containing a total of 16 marketing districts are shown on a map in the report. Trend charts are included showing average properties of the six grades of fuel for the past several years. Summaries of the results of the tests by grade and by region for 1981 compared with data for 1980 are shown in Tables 1 through 6. Analyses of grade 6 foreign import oils are presented in Table 13.

32986 **(DOE/ET/12056—27) Effects of confining pressure, pore pressure and temperature on absolute permeability. SUPRI TR-27.** Gobran, B.D.; Ramey, H.J. Jr.; Brigham, W.E. (Stanford Univ., CA (USA). Petroleum Research Inst.). Oct 1981. Contract AC03-76ET12056. 115p. NTIS, PC A06/MF A01. Order Number DE81030336.

This study investigates absolute permeability of consolidated sandstone and unconsolidated sand cores to distilled water as a function of the confining pressure on the core, the pore pressure of the flowing fluid and the temperature of the system. Since permeability measurements are usually made in the laboratory under conditions very different from those in the reservoir, it is important to know the effect of various parameters on the measured value of permeability. All studies on the effect of confining pressure on absolute permeability have found that when the confining pressure is increased, the permeability is reduced. The studies on the effect of temperature have shown much less consistency. This work contradicts the past Stanford studies by finding no effect of temperature on the absolute permeability of unconsolidated sand or sandstones to distilled water. The probable causes of the past errors are discussed. It has been found that inaccurate measurement of temperature at ambient conditions and non-equilibrium of temperature in the core can lead to a fictitious permeability reduction with temperature increase. The results of this study on the effect of confining pressure and pore pressure support the theory that as confining pressure is increased or pore pressure decreased, the permeability is reduced. The effects of confining pressure and pore pressure changes on absolute permeability are given explicitly so that measurements made under one set of confining pressure/pore pressure conditions in the laboratory can be extrapolated to conditions more representative of the reservoir.

## 0240 Storage

32987 **(LA-UR—81-2622) Microseismic activity observed during depressurization of an oil storage cavern in rock salt.** Albright, J.; Pearson, C. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 13p. (CONF-811036—1). NTIS, PC A02/MF A01. Order Number DE81030237.

From 3. conference on acoustic emission/microseismic activity in geologic structures and materials; University Park, PA, USA (5 Oct 1981).

In November 1978, the Los Alamos National Laboratory installed a triaxial downhole geophone package at the Bryan Mound Strategic Petroleum Reserve, a salt dome near Freeport, Texas. Monitoring was for the purpose of detecting microseismic activity during the depressurization of one of the oil storage caverns. Seismic activity started soon after the start of depressurization, reached a peak 5 days later, and rapidly died off. Nineteen locatable microearthquakes with magnitudes between -1 and -2 were observed during and after depressurization. All but two of these events were located near the side of the oil storage cavern. Because the shear-wave spectra of these events were characterized by well-defined corner frequencies we were able to calculate the radius of the rupture surface, the seismic moment, and the stress drop from the source spectra. Estimates of the source radius vary from 15 to 100 m, stress drops range from 0.3 to 0.01 bar, and seismic moments range from $3 \times 10^{14}$ to $3 \times 10^{15}$ dyne/cm. Important conclusions from this study are that comparatively small changes in the internal pressure of oil storage caverns may be enough to cause failure in the salt near the cavern walls and that downhole microseismic surveys can locate zones near large underground excavations that are undergoing rock failure.

## 0250 Combustion

*REFER ALSO TO CITATION(S) 32950, 32951, 32953, 32985*

32988 **(DOE/BETC/PPS—81/3) Motor gasolines, Winter 1980-81.** Shelton, E.M. (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). Jul 1981. 67p. NTIS, PC A04/MF A01. Order Number DE81030845.

Analytical data for 546 samples of motor gasoline, were collected from service stations throughout the country and were analyzed in the laboratories of various refiners, motor manufacturers, and chemical companies. The data were submitted to the Bartlesville Energy Technology Center for study, necessary calculations, and compilation under a cooperative agreement between the Bartlesville Energy Technology Center (BETC) and the American Petroleum Institute (API). The samples represent the products of 23 companies, large and small, which manufacture and supply gasoline. These data are tabulated by groups according to brands (unlabeled) and grades for 17 marketing districts into which the country is divided. A map included in this report, shows marketing areas, districts and sampling locations. The report also includes charts indicating the trends of selected properties of motor fuels since 1959. Sixteen octane distribution percent charts for areas 1, 2, 3, and 4 for unleaded antiknock index (R+M)/2 below 90.0, unleaded antiknock index (R+M)/2 90.0 and above, leaded antiknock index (R+M)/2 below 93.0, and leaded antiknock index (R+M)/2 93.0 and above grades of gasoline are presented in this report. The antiknock (octane) index (R+M)/2 averages of gasoline sold in this country were 87.6 unleaded below 90.0, 91.4 unleaded 90.0 and above, 89.1 leaded below 93.0, and 93.3 leaded 93.0 and above grades of gasoline.

**32989 (EPRI-CS—1995) Particulate emission characteristics of oil-fired urtility boilers.** Piper, B.F.; Hersh, S.; Mormile, D.J. (KVB, Inc., Elmsford, NY (USA); Consolidated Edison Co. of New York, Inc., New York (USA)). Aug 1981. 95p. NTIS, PC A05/MF A01. Order Number DE81904193.

The size distribution and composition of particulate emissions from three oil fired utility boilers were determined under representative nominal operating conditions. In addition, the variability of particulate size and compositional characteristics with changes in furnace excess air level and fuel atomization quality was obtained from one boiler as an indication of the fluctuations in particulate emissions which could be anticipated as a result of variable operating practices. The three test boilers included a 360 MW tangentially fired boiler, a 345 MW face fired boiler and a 150,000 lb/hr steam sendout package boiler - all burning a low sulfur (0.24%) fuel oil. The particulate emissions from the 360 MW tangentially fired boiler exhibited a submicron single mode size distribution with a number mean on the order of 0.05 microns. Reduction in excess air levels to the smoking threshold did not modify this distribution. However, reduction in the atomization quality of the fuel sprays resulted in a bi-modal distribution consisting of large (greater than 10 microns) porous particles in addition to the submicron population. Data from both the 345 MW face fired boiler and a 150,000 lb/hr steam sendout package boiler showed a bi-modal distribution under normal operating conditions. Particulate composition analyses demonstrated increases in carbon for both the reduced excess air and reduced atomization quality tests. Sulfate emissions were also found to increase for the atomization tests. Scanning Auger microprobe analysis combined with an argon ion milling technique indicated that this sulfate was found as a surface layer on the large carbonaceous particulates emitted under this operating condition.

# 03 NATURAL GAS

*REFER ALSO TO CITATION(S) 33494*

## 0301 Reserves

*REFER ALSO TO CITATION(S) 33386*

## 0302 Geology And Exploration

*REFER ALSO TO CITATION(S) 32962*

**32990 (CONF-811026—5) Assessment of in-place solution methane in tertiary sandstones: Texas Gulf Coast.** Gregory, A.R.; Dodge, M.M.; Posey, J.S.; Morton, R.A. (Texas Univ., Austin (USA). Bureau of Economic Geology). 1981. Contract AC08-78ET11397. 8p. NTIS, PC A02/MF A01. Order Number DE81029772.

From 5. geopressured-geothermal energy conference; Baton Rouge, LA, USA (13 Oct 1981).

The higher prices obtained for commercial natural gas in recent years have stimulated interest in methane-saturated formation waters of sandstone reservoirs in the Texas Gulf Coast as a potential alternative source of energy. The objective of this project was to appraise the total volume of in-place methane dissolved in formation waters of deep sandstone reservoirs of the onshore Texas Gulf Coast within the stratigraphic section extending from the base of significant hydrocarbon production (8000 ft) to the deepest significant sandstone occurrence. Factors that must be evaluated to determine the total methane resource are reservoir bulk volume, porosity, and methane solubility. The latter is controlled by the temperature, pressure, and salinity of formation waters. Regional assessment of the volume and distribution of potential sandstone reservoirs was made from a data base of 880 electrical well logs, from which a grid of 24 structural dip cross sections and 4 strike cross sections was constructed. These cross sections extend from near the Wilcox outcrop to the coastline. Reservoir bulk volume was determined by mapping the structural and stratigraphic framework of Tertiary sandstone units. Structural and stratigraphic boundaries were used to divide the Texas Gulf Coast into 24 subdivisions. Methane content in each of nine formations or divisions of formations was determined for each subdivision. The total in-place methane for Tertiary sandstones below 8000 ft in the Texas Gulf Coast was found to be 690 TCF.[2] The total in-place methane for effective Tertiary sandstones (sandstone units greater than 30 ft thick) below 8000 ft was 325 TCF.

## 0303 Drilling, Production, And Processing

*REFER ALSO TO CITATION(S) 33223*

**32991 (CONF-811026—6) Salinity of deep formation waters, Texas Gulf Coast - preliminary results.** Morton, R.A.; Posey, J.S.; Garrett, C.M. Jr. (Texas Univ., Austin (USA). Bureau of Economic Geology). 1981. Contract AC08-79ET27111; AC08-79ET27112. 10p. NTIS, PC A02/MF A01. Order Number DE81029773.

From 5. geopressured-geothermal energy conference; Baton Rouge, LA, USA (13 Oct 1981).

Vertical variation in salinity can be either systematic or unpredictable. The widely reported decrease in salinity near the top of geopressure led some workers to erroneously conclude that salinities in the geopressured zone are less than in the hydropressured zone. Indeed, salinities are lowest in the transition zone, but in many areas, salinities of geopressured reservoirs tend to gradually increase with depth. High salinities at depth have been explained by hyperfiltration and proximity to salt domes. Apparently both mechanisms are responsible for some high salinities in the Frio Formation; however, concentrated brines are not necessarily indicative of salt dissolution as shown by water analyses from south Texas. This area is far removed from any known salt accumulations and yet salinities of formation water from some fields are greater than 200,000 ppM. On a local scale, lateral variations in salinity are minor and wells within the same fault-bounded reservoir produce waters with nearly uniform salinities. For intermediate ranges (35,000-70,000 ppM), well to well variations are generally less than 20,000 ppM. Even reservoirs that are stratigraphically equivalent but separated by minor faults produce waters with similar salinities. The greatest differences in salinity are found in stratigraphically separated reservoirs.

## 0306 Marketing And Economics

*REFER ALSO TO CITATION(S) 32982*

## 0309 Artificial Stimulation

**32992 (DOE/MC/11577—T23) Small-scale experiments with an analysis to evaluate the effect of tailored pulse loading on fracture and permeability. Final report for Phase II, June 11, 1980-June 11, 1981.** McHugh, S. (SRI International, Menlo Park, CA (USA)). Jun 1981. Contract AC21-79MC11577. 139p. NTIS, PC A07/MF A01. Order Number DE81027463.

The ultimate objective of the pulse-tailoring program is to evaluate input pulse shape, and associated gas pressurization, effects on fracture and permeability enhancement in selected geologic formations. Although the pulse-tailoring technique will ultimately be applied to Devonian shale, the majority of the work to date has been on tuff. The effect of pulse shape on tuff and the application of pulse tailoring to Devonian shale are discussed. Seven significant conclusions drawn from these studies are: (1) preshot-to-postshot permeability enhancement of 2 to 3 orders of magnitude; (2) fracture initiation and growth caused by tensile stresses propagating into the surrounding formation, fracture extension resulting from penetration of borehole gas into the stress-wave-induced fractures, and fragmentation caused by crack coalescence; (3) rise time of the tensile hoop stresses and peak amplitude of radial stress; (4) effects of pulse tailoring are material dependent; (5) effect of increases in overburden stress indicate a reduction in tensile-stress-induced fracturing; (6) fracture and permeability enhancement have been predicted in field tests; and (7) pulse tailoring can enhance permeability even in completely fractured material.

# 04 OIL SHALES AND TAR SANDS

*REFER ALSO TO CITATION(S) 33494*

## 0401 Reserves And Exploration

*REFER ALSO TO CITATION(S) 33386*

## 0404 Oil Production, Recovery, And Refining

*REFER ALSO TO CITATION(S) 32862, 32995*

32993 **(SAND—81-1128) Failure surface model for oil shale.** Costin, L.S. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 43p. NTIS, PC A03/MF A01. Order Number DE81030987.

One promising means of recovering oil from oil shale is to retort the shale in situ. Currently, modified in situ technology requires the construction of extensive underground openings or retorts. The remaining media (structure left around these retorts must support the overburden and contain the retorting shale. A failure criterion for oil shale, which is presented in this paper, was developed so that regions in the retort structure where the shale may be approaching failure can be identified. This criterion, adapted from composite materials applications, is essentially a closed surface in six-dimensional stress space and makes it possible to describe the anisotropic nature of failure in layered materials. The failure surface can be defined by five parameters which are determined from five simple laboratory tests. The surface is developed for a 80 ml/kg kerogen content shale and its features are discussed in detail. The predictions of the model are found to be in agreement with the results of a large number of laboratory tests, including uniaxial and triaxial compression tests. One unique (for rocks) test series is discussed which involves the failure of thin-walled tubes under combined compression and torsion. Finally, it is shown how the model can be extended to include the variation of material properties with kerogen content and temperature.

32994 **(UCID—16986-81-2) Lawrence Livermore National Laboratory Oil-Shale Project. Quarterly report, April-June 1981.** Lewis, A.E. (ed.). (Lawrence Livermore National Lab., CA (USA)). 1 Sep 1981. Contract W-7405-ENG-48. 18p. NTIS, PC A02/MF A01. Order Number DE81030315.

The one-dimensional packed-bed retort model was used to study the effect of dawsonite decomposition during hot, inert-gas in-situ retorting. A process simulation code has been written for a Staged Turbulent Bed Retorting Process. Pyrolysis of oil shale in material-balanced Fischer assays was carried out on a large number of shale samples. Fluidization of oil shale particles has been measured at room temperature. (DLC)

## 0405 Properties And Composition

32995 **(LA—8792-MS) Investigations of Occidental Oil Shale, Inc., retort 3E spent shales.** Peterson, E.J.; Henicksman, A.; Wagner, P. (Los Alamos Scientific Lab., NM (USA)). Jun 1981. Contract W-7405-ENG-36. 41p. NTIS, PC A03/MF A01. Order Number DE81032017.

The mineralogy, trace element concentrations in the solids, and leaching characteristics of spent shales from retort 3E cores were studied. This is the first comprehensive study of in situ generated materials. Although there were unique aspects to the operations of retort 3E that are not representative of a commercial operation, the study of in situ generated materials has provided insights into the chemical, mineralogic, and solution reactions that occur during and subsequent to underground retorting. Characterization of the solid materials has verified that in situ processing occurs in a thermodynamic and kinetic regime not previously encountered for surface retorting. Carbonate decomposition and silication reactions that form high-temperature products, such as akermanite-gehlenite and diopside-augite solid solutions, have been identified by x-ray diffraction. Observations resulting from solids characterization are substantiated by leachate chemistry, which, although compatible with leachates generated from surface retorted materials, are different in extent (composition and concentration). Comparison of leachates generated from in situ materials with Multi-Media Environmental Goals/Minimum Acute Toxicity Effluent values indicates that the major and trace elements deserving further investigation are potassium, lithium, fluoride, vanadium, boron, molybdenum, nickel, and arsenic. Several trace elements, including fluoride, vanadium, boron, and arsenic, show increased mobilities from spent shales containing akermanite-gehlenite solid solutions as the major mineral phase. This report details the chemical, mineralogic, and solution behavior of major, minor, and trace elements in these minerals.

## 0408 Marketing And Economics

*REFER ALSO TO CITATION(S) 32976*

32996 **(DOE/SF/10852—T1) Transportation and marketing plan.** (Colorado School of Mines, Golden (USA). Research Inst.). Aug 1981. Contract FC03-80SF10852. 69p. NTIS, PC A04/MF A01. Order Number DE81030491.

Two discrete levels of shale oil production were evaluated during the course of the investigation. The first was a 15,000-barrel-per-day production level from the single-module demonstration program between 1987 and 1990. The second was a full-scale commercial production level of 50,000 barrels per day commencing in 1990. Also assumed were two levels of total industry production during these time periods; a total of 300,000 barrels per day from 1987 to 1990, and 400,000 barrels per day thereafter. Based on the above assumptions and information acquired during the investigation, CSMRI examined potential markets and possible transportation methods and evaluated each possible option with respect to market quality, transportation mode viability, and direct engineering cost calculations. The result was a rating of each option based on the net value of the raw shale oil at the Pacific plant site qualified by the characteristics of the market and the feasibility of employing the particular transportation method. The economic evaluations were then subjectively weighed against the market and transportation considerations to determine the most likely option(s) to be employed in any future marketing program.

## 0409 Waste Research And Management

*REFER ALSO TO CITATION(S) 32997*

## 0410 Enviromental Aspects

32997 **(PNL-SA—9792) Effects of oil-shale solid-waste disposal on water quality: current knowledge, information requirements, and research strategy.** Wildung, R.E.; Zachara, J.M. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Aug 1981. Contract AC06-76RL01830. 34p. (CONF-810838—2). NTIS, PC A03/MF A01. Order Number DE81030105.

From Conference on oil shale, the environmental challenges II; Vail, CO, USA (10 Aug 1981).

This paper is an extension of a recent, more detailed review of aboveground retorting and the geochemistry/hydrology of oil shale solid waste disposal (Wildung and Zachara, 1981) and briefly describes (1) the key environmental issues associated with waste disposal in the developing oil shale industry, (2) the role of the research community in resolving these issues, and (3) a conceptualized approach for integrating current knowledge, identifying critical information needs, and conducting research to predict impacts of solutes from solid wastes on water quality and facilitate development of acceptable solid waste management strategies.

32998 **(UCRL—53197) Environmental, health, safety, and socioeconomic impacts associated with oil recovery from tar-sand deposits in the United States.** Daniels, J.I. (Lawrence Livermore National Lab., CA (USA)). 12 Sep 1981. Contract W-7405-ENG-48. 182p. NTIS, PC A09/MF A01. Order Number DE81031929.

Estimates of potential pollution-emission levels affecting land, air, and water were calculated from available data related to

current surface and in situ tar-sand field experiments in the US. These data were then extrapolated to determine pollutant levels expected from conceptual commercial surface and in situ facilities producing 20,000 bbl/d. The likelihood-of-occurrence of these impacts was then assessed. Experience from other industries, including information concerning health and ecosystem damage from air pollutants, measurements of ground-water transport of organic pollutants, and the effectiveness of environmental-control technologies was used to make this assessment. Conclusions reached from this assessment are that certain effects are more likely to occur than others. In this final report these effects are discussed and ordered according to their likelihood-of-occurrence for surface and in situ tar-sand oil extraction technologies.

# 05 NUCLEAR FUELS

## 0501 Reserves

*REFER ALSO TO CITATION(S) 33386*

**32999 (ORNL/CSD/TM—155-Vol.1) Preparation of magnetic anomaly profile and contour maps from DOE-NURE aerial survey data. Volume I: processing procedures.** Tinnel, E.P.; Hinze, W.J. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 139p. NTIS, PC A07/MF A01. Order Number DE81030700.

Total intensity magnetic anomaly data acquired as a supplement to radiometric data in the DOE National Uranium Resource Evaluation (NURE) Program are useful in preparing regional profile and contour maps. Survey-contractor-supplied magnetic anomaly data are subjected to a multiprocess, computer-based procedure which prepares these data for presentation. This procedure is used to produce the following machine plotted maps of National Topographic Map Series quadrangle units at a 1:250,000 scale: (1) profile map of contractor-supplied magnetic anomaly data, (2) profile map of high-cut filtered data with contour levels of each profile marked and annotated on the associated flight track, (3) profile map of critical-point data with contour levels indicated, and (4) contour map of filtered and selected data. These quadrangle maps are supplemented with a range of statistical measures of the data which are useful in quality evaluation.

**33000 Fuel availability--uranium results of INFCE investigations.** Patterson, J.A. (DOE, Washingon, DC). pp vp of Atomic Industrial Forum, Inc., fuel cycle conference, 1980. Bethesda, MD; Atomic Industrial Forum, Inc. (1980).

From Fuel cycle conference; New Orleans, LA, USA (15 Apr 1980).

In the execution of the studies of the International Nuclear Fuel Cycle Evaluation (INFCE) project, the task of examining fuel availibilty was assigned to Working Group 1. The assignment covered uranium, thorium, and heavy water, including projected long-term requirements, the current and anticipated supplies, and the interrelationship between supply and demand. Four subgroups were formed to deal with the assignment. Subgroup A worked to develop forecasts of nuclear power growth and estimates of related fuel and enrichment requirements. This paper refers to some of the findings of Subgroup A, concentrating on the uranium fuel supply and demand aspects. It is concluded that uranium supplies can be expected to be available to support a substantial growth in nuclear capacity. Uncertainties do remain about the magnitude of world resources and their availability over the long term, but there are means to reduce these uncertainties.

## 0502 Exploration

**33001 (GJBX—125(81)) Geochemical exploration for uranium in the Red Desert, Wyoming.** Pacer, J.C.; Bramlett, L.; Moll, S. (Bendix Field Engineering Corp., Grand Junction, CO (USA); Anaconda Corp., Denver, CO (USA); Colorado State Univ., Fort Collins (USA)). May 1981. Contract AC13-76GJ01664. 38p. NTIS, PC A03/MF A01. Order Number DE81027159.

Geochemical exploration techniques for uranium were performed at a known deposit, the ENQ uranium deposit, which is in arkosic sandstones of the Battle Spring Formation in the Red Desert of Wyoming. Regional gross-gamma aerial data did not indicate the most favorable terrain for follow-up surveys, but instead the radionuclide distribution mapped radioactive mudstones. The $^{234}U/^{238}U$ activity ratio and total uranium concentration in ground water were successful downflow indicators of the ENQ deposit. Helium concentration increased downflow in the ground water flowing from the deposit, while Cu, Pb, and Ba decreased. Radon emanometric techniques generally produced data that coincided with the equivalent uranium concentrations at shallow depth. Helium content in soil was interpreted to reflect local lithology and gaseous migration. Multielement geochemical analyses on soils were effective in delineating the general vicinity of the orebody. Factor analysis was used to recognize three lithologic subgroups. Leachable uranium in soils was the best indicator of subsurface mineralization for the entire subregional area. Equivalent uranium, as determined from the gamma-spectral borehole logs, revealed a consistent dispersion pattern within the host sand of the Battle Spring Formation, whereas gross gamma logs could not detect the subtle gradients in radioelement content. Halo models developed to explain the distribution of helium, radon, radioelements, and trace elements demonstrate uranium itself as the most mobile indicator. Radon and helium appear to reflect local generation from radium accumulations. Vertical leakage due to hydraulic flow against an impermeable barrier is interpreted to be the major secondary redistribution process responsible for the measureable surface signals.

**33002 (GJBX—218-81) Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 29 May 1981. Contract W-7405-ENG-26. 380p. (K/UR—153). NTIS, PC E12/MF A01. Order Number DE81027988.

Includes 1 sheet of 48x reduction microfiche.

Results of a reconnaissance geochemical survey of the Escanaba Quadrangle, Michigan; Wisconsin are reported. Statistical data and areal distributions for uranium and uranium-related variables are presented for 382 groundwater and 171 stream sediment samples. Also included is a brief discussion on location and geologic setting. Low 85th percentile values coupled with nonexistent trends indicate very little or no probability of significant uranium mineralization in the Escanaba quadrangle.

**33003 (GJBX—219-81) Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 29 May 1981. Contract W-7405-ENG-26. 284p. (K/UR—155). NTIS, PC E10/MF A01. Order Number DE81027866.

Includes 1 sheets of 48x reduction microfiche.

Results of a reconnaissance geochemical survey of the Watertown Quadrangle are reported. Field and laboratory data are presented for 711 groundwater and 603 stream sediment samples. Statistical and areal distributions of uranium and possible uranium-related variables are displayed. A generalized geologic map of the survey area is provided, and pertinent geologic factors which may be of significance in evaluating the potential for uranium mineralization are briefly discussed. Groundwater data indicate that high uranium concentrations are derived predominantly from glacial aquifers of variable water composition located on the Coteau des Prairies. Elements associated with high uranium values in these waters include barium, calcium, copper, iron, magnesium, selenium, sulfate, and total alkalinity. Low uranium values were observed in waters originating from the Cretaceous Dakota sandstone whose water chemistry is characterized by high concentrations of boron, sodium, and chloride. Stream sediment data indicate that high uranium concentrations are scattered across the glacial deposits of the Coteau des Prairies. A major clustering of high uranium values occurs in the eastern portion of the glaciated quadrangle and is associated with high concentrations of selenium, lithium, iron, arsenic, chromium, and vanadium. The sediment data suggest that the drift covering the Watertown Quadrangle is compositionally homogeneous, although subtle geochemical differences were observed as a result of localized contrasts in drift source-rock mineralogy and modification of elemental distributions by contemporaneous and postglacial hydrologic processes.

**33004 (GJBX—229-81) Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 29 May 1981. Contract W-7405-ENG-26. 267p. (K/UR—152). NTIS, PC A12/MF A01. Order Number DE81028638.

Includes 1 sheet of 48x reduction microfiche.

Results of a reconnaissance geochemical survey of the Lincoln Quadrangle are reported. Field and laboratory data are presented for 577 groundwater and 754 stream sediment samples. Statistical and areal distributions of uranium and possible uranium-related variables are displayed. A generalized geologic map of the survey area is provided, and pertinent geologic factors which may be of significance in evaluating the potential for uranium mineralization are briefly discussed. Groundwater data indicate no favorable areas for uranium mineralization. Groundwater samples with anomalous uranium values are widely scattered across the quadrangle and do not appear to follow a geologic unit or trend. Eighty-five percent of the groundwater samples were collected from Quaternary material, which accounts for the lack of variation in the groundwater data. Stream sediment data do not show any large clusters of high uranium concentrations but indicate individual high uranium values distributed throughout the quadrangle. Anomalous total uranium values appear to be related to anomalous titanium and zirconium values. Ninety-six percent of the stream sediment samples were derived from the Quaternary sediments which blanket the Lincoln Quadrangle. No favorable areas for uranium exploration are indicated by the stream sediment data.

**33005 (GJBX—241-81-Vol.1) Airborne gamma-ray spectrometer and magnetometer survey: Peoria, Decater, Belleville Quadrangles, (IL). Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). 1981. Contract AC13-79GJ01692. 73p. NTIS, PC E10/MF $16.10. Order Number DE81028641.

Includes 67 sheets of 48x reduction microfiche.

An airborne combined radiometric and magnetic survey was performed for the Department of Energy (DOE) over the area covered by the Peoria, Decatur, and Belleville, 1:250,000 National Topographic Map Series (NTMS), quadrangle maps. The survey was part of DOE's National Uranium Resource Evaluation (NURE) program. Data were collected by a helicopter equipped with a gamma-ray spectrometer with a large crystal volume, and with a high sensitivity proton procession magnetometer. The radiometric system was calibrated at the Walker Field Calibration pads and the Lake Mead Dynamic Test Range. Data quality was ensured during the survey by daily test flights and equipment checks. Radiometric data were corrected for live time, aircraft and equipment background, cosmic background, atmospheric radon, Compton scatter, and altitude dependence. The corrected data were statistically evaluated, plotted, and contoured to produce anomaly maps based on the radiometric response of individual geological units. The anomalies were interpreted and an interpretation map produced. Volume I contains a description of the systems used in the survey, a discussion of the calibration of the systems, the data collection procedures, the data processing procedures, the data presentation, the interpretation rationale, and the interpretation methodology. A separate Volume II for each quadrangle contains the data displays and the interpretation results.

**33006 (GJBX—243-81) Stream sediment detailed geochemical survey for Date Creek Basin, Arizona.** Butz, T.R.; Tieman, D.J.; Grimes, J.G.; Bard, C.S.; Helgerson, R.N.; Pritz, P.M.; Wolf, D.A. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 30 Jun 1981. Contract W-7405-ENG-26. 68p. (K/UR—34-Suppl.1). NTIS, PC A04/MF A01. Order Number DE81028166.

The purpose of the Date Creek Supplement is to characterize the chemistry of sediment samples representing stream basins in which the Anderson Mine (and related prospects) occur. Once characterized, the chemistry is then used to delineate other areas within the Date Creek Basin where stream sediment chemistry resembles that of the Anderson Mine area. This supplementary report examines more closely the data from sediment samples taken in 239 stream basins collected over a total area of approximately 900 $km^2$ (350 $mi^2$). Cluster and discriminant analyses are used to characterize the geochemistry of the stream sediment samples collected in the Date Creek Basin. Cluster and discriminant analysis plots are used to delineate areas having a potential for uranium mineralization similar to that of the Anderson Mine.

**33007 (GJBX—272-81) Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 30 Jun 1981. Contract W-7405-ENG-26. 61p. (K/UR—337). NTIS, PC E03/MF A01. Order Number DE81030292.

Includes 1 sheet of 48x reduction microfiche.

Field and laboratory data are presented for 82 water samples from the Barrow Quadrangle, Alaska. The samples were collected by Los Alamos National Laboratory; laboratory analysis and data reporting were performed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

**33008 (GJBX—275-81) Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 30 Jun 1981. Contract W-7405-ENG-26. 97p. (K/UR—349). NTIS, PC E04/MF A01. Order Number DE81030294.

Field and laboratory data are presented for 574 water samples from the Ikpikpuk River Quadrangle, Alaska. The samples were collected by Los Alamos National Laboratory; laboratory analysis and data reporting were performed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

**33009 (GJBX—276-81) Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 30 Jun 1981. Contract W-7405-ENG-26. 101p. (K/UR—352). NTIS, PC E05/PC A01. Order Number DE81030289.

Includes 1 sheet of 48x reduction microfiche.

Field and laboratory data are presented for 620 water samples from the Mishequk Mountain Quadrangle, Alaska. The samples were collected by Los Alamos National Laboratory; laboratory analysis and data reporting were performed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

**33010 (GJBX—277-81) Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 31 Jul 1981. Contract W-7405-ENG-26. 97p. (K/UR—355). NTIS, PC E04/MF A01. Order Number DE81030281.

Includes 1 sheet of 48x reduction microfiche.

Field and laboratory data are presented for 585 water samples from the Unalakleet Quadrangle, Alaska. The samples were collected by Los Alamos National Laboratory; laboratory analysis and data reporting were performed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

**33011 (GJBX—278-81) Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 31 Jul 1981. Contract W-7405-ENG-26. 85p. (K/UR—357). NTIS, PC E04/MF A01. Order Number DE81030290.

Includes 1 sheet of 48x reduction microfiche.

Field and laboratory data are presented for 437 water samples from the Petersburg Quadrangle, Alaska. The samples were collected by Los Alamos National Laboratory; laboratory analysis and data reporting were performed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

**33012 (GJBX—279-81) Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 30 Jun 1981. Contract W-7405-ENG-26. 97p. (K/UR—358). NTIS, PC E04/MF A01. Order Number DE81030291.

Includes 1 sheet of 48x reduction microfiche.

Field and laboratory data are presented for 562 water samples from the Sagavanirktok Quadrangle, Alaska. The samples were

collected by Los Alamos National Laboratory; laboratory analysis and data reporting were performed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

33013 **(LA—6647-MS) One hundred prime references on hydrogeochemical and stream sediment surveying for uranium as internationally practiced, including 60 annotated references.** Sharp, R.R. Jr.; Bolivar, S.L. (Los Alamos National Lab., NM (USA)). Apr 1981. Contract W-7405-ENG-36. 92p. NTIS, PC A05/MF A01. Order Number DE81029139.

The United States Department of Energy (DOE), formerly the US ERDA, has initiated a nationwide Hydrogeochemical and Stream Sediment Reconnaissance (HSSR). This program is part of the US National Uranium Resource Evaluation, designed to provide an improved estimate for the availability and economics of nuclear fuel resources and make available to industry information for use in exploration and development of uranium resources. The Los Alamos National Laboratory is responsible for completing the HSSR in Rocky Mountain states of New Mexico, Colorado, Wyoming, and Montana and in the state of Alaska. This report contains a compilation of 100 prime references on uranium hydrogeochemical and stream sediment reconnaissance as internationally practiced prior to 1977. The major emphasis in selection of these references was directed toward constructing a HSSR program with the purpose of identifying uranium in the Los Alamos National Laboratory area of responsibility. The context of the annotated abstracts are the authors' concept of what the respective article contains relative to uranium geochemistry and hydrogeochemical and stream sediment surveying. Consequently, in many cases, significant portions of the original articles are not discussed. The text consists of two parts. Part I contains 100 prime references, alphabetically arranged. Part II contains 60 select annotated abstracts, listed in chronological order.

33014 **(LA—8807-MS) Multisource data set integration and characterization of uranium mineralization for the Montrose Quadrangle, Colorado.** Bolivar, S.L.; Balog, S.H.; Campbell, K.; Fugelso, L.E.; Weaver, T.A.; Wecksung, G.W. (Los Alamos National Lab., NM (USA)). Apr 1981. Contract W-7405-ENG-36. 179p. NTIS, PC A09/MF A01. Order Number DE81030499.

Several data-classification schemes were developed by the Los Alamos National Laboratory to detect potential uranium mineralization in the Montrose $1^0$ x $2^0$ quadrangle, Colorado. A first step was to develop and refine the techniques necessary to digitize, integrate, and register various large geological, geochemical, and geophysical data sets, including Landsat 2 imagery, for the Montrose quadrangle, Colorado, using a grid resolution of 1 km. All data sets for the Montrose quadrangle were registered to the Universal Transverse Mercator projection. The data sets include hydrogeochemical and stream sediment analyses for 23 elements, uranium-to-thorium ratios, airborne geophysical survey data, the locations of 90 uranium occurrences, a geologic map and Landsat 2 (bands 4 through 7) imagery. Geochemical samples were collected from 3965 locations in the 19 200 $km^2$ quadrangle; aerial data were collected on flight lines flown with 3 to 5 km spacings. These data sets were smoothed by universal kriging and interpolated to a 179 x 119 rectangular grid. A mylar transparency of the geologic map was prepared and digitized. Locations for the known uranium occurrences were also digitized. The Landsat 2 imagery was digitally manipulated and rubber-sheet transformed to quadrangle boundaries and bands 4 through 7 were resampled to both a 1-km and 100-m resolution. All possible combinations of three, for all data sets, were examined for general geologic correlations by utilizing a color microfilm output. Subsets of data were further examined for selected test areas. Two classification schemes for uranium mineralization, based on selected test areas in both the Cochetopa and Marshall Pass uranium districts, are presented. Areas favorable for uranium mineralization, based on these schemes, were identified and are discussed.

33015 **(LA-UR—81-2451) Resource characterization for uranium mineralization in the Montrose $1^0$ x $2^0$ quadrangle, Colorado.** Bolivar, S.L.; Balog, S.H.; Weaver, T.A. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 13p. (CONF-810949—1). NTIS, PC A02/MF A01. Order Number DE81030110.

From 5. uranium seminar; Albuquerque, NM, USA (Sep 1981).

A data-classification scheme was developed to detect potential uranium mineralization in the Montrose $1^0$ x $2^0$ quadrangle, Colorado. The methodology developed is a rapid and efficient method of resource evaluation on a reconnaissance scale. The necessary techniques were developed and refined to digitize, integrate, and register various large geological, geochemical, and geophysical data sets for the Montrose quadrangle, Colorado, using a grid resolution of 1 km. All data sets for the Montrose quadrangle were registered to the Universal Transverse Mercator projection. The data sets include hydrogeochemical and stream sediment analyses for 23 elements, uranium-to-thorium ratios, airborne geophysical survey data, the locations of 90 uranium occurrences, and a geologic map (scale 1:250 000). Geochemical samples were collected from 3965 locations in the 19 200 $km^2$ quadrangle; aerial data were collected on flight lines flown with 3 to 5 km spacings. These data sets were smoothed by universal kriging and interpolated to a 179 x 119 rectangular grid (each grid block is 1 $km^2$). A mylar transparency of the geologic map was prepared and digitized. All possible combinations of three, for all data sets, were examined for general geologic correlations by utilizing a color microfilm output. Subsets of data were further examined for selected test areas. A classification scheme for uranium mineralization, based on selected test areas in the Cochetopa uranium district, is presented. Areas favorable for uranium mineralization, based on this scheme, were identified and are discussed.

## 0505 Enrichment

33016 **(LA-UR—81-1821) Numerical simulation of the countercurrent flow in a gas centrifuge.** Cloutman, L.D.; Gentry, R.A. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 29p. (CONF-810845—2). NTIS, PC A03/MF A01. Order Number DE81030283.

From 4. workshop on gases in strong rotation; Oxford, UK (24 Aug 1981).

A finite difference method is presented for the numerical simulation of the axisymmetric countercurrent flows in gas centrifuge. A time-marching technique is used to relax an arbitrary initial condition to the desired steady-state solution. All boundary layers may be resolved, and nonlinear effects may be included. Numerical examples are presented. It is concluded that this technique is capable of accurately predicting the performance of a wide variety of machines under all operating conditions of interest.

33017 **Uranium enrichment: response to an energy crisis.** pp vp of Atomic Industrial Forum, Inc., fuel cycle conference, 1980. Bethesda, MD; Atomic Industrial Forum, Inc. (1980).

From Fuel cycle conference; New Orleans, LA, USA (15 Apr 1980).

The Office of Uranium Resources and Enrichment (OURE) has developed a posture to help create the stability throughout the 1980's that is required for nuclear power to support the necessary transition from petroleum to more desirable energy alternatives. This posture is constructed from actions in uranium enrichment program to: (1) ensure an adequate and reliable supply; (2) maintain low prices; and (3) meet customer needs for flexibility via program initiatives. This article briefly discusses these factors.

## 0507 Fuels Production And Properties

*REFER ALSO TO CITATION(S) 33621, 33625*

## 0508 Spent Fuels Reprocessing

*REFER ALSO TO CITATION(S) 33059, 33318, 33572, 33622, 33800*

## 0509 Transport And Storage

*REFER ALSO TO CITATION(S) 33019, 33635*

**33018 (DOE/SR/01069—1) DISFUL manual.** Jain, M.; Franks, W.A. (Stoller (S.M.) Corp., New York (USA)). Aug 1981. Contract AC09-78SR01069. 220p. NTIS, PC A10/MF A01. Order Number DE81030483.

The DISFUL code is a computer simulation for a period of 25 years of the spent nuclear fuel storage, transportation, and disposal network in the US. Foreign spent fuel can also be treated as delivered at specified ports of entry. The code has been programmed with a large number of options that allow one to specify a very flexible set of scenarios for modelling and testing various federal, utility and private entreprenurial policies on spent fuel transportation, storage and disposal. The DISFUL code is written in FORTRAN IV and is operational on CDC-7600. It requires 462,000 octal bits of storage and 11 tape or disk drives to operate.

## 0510 Marketing And Economics

*REFER ALSO TO CITATION(S) 33000, 33017, 33045, 33061, 33391*

**33019 Atomic Industrial Forum Inc., fuel cycle conference, 1980.** Bethesda, MD; Atomic Industrial Forum, Inc. (1980). vp. (CONF-8004168—).

From Fuel cycle conference; New Orleans, LA, USA (15 Apr 1980).

This Proceedings contains a collection of 18 contributed and invited papers by various authors. The papers are grouped under the following session titles: INFCE--key findings; uranium and enrichment services; fuel cycle; radioactive waste disposal and spent fuel storage; and low-level radioactive waste. Seventeen papers are separately indexed.

## 0520 Waste Management

*REFER ALSO TO CITATION(S) 33019, 33047, 33048, 33049, 33050, 33051, 33052, 33053, 33054, 33055, 33056, 33382, 33591, 33622, 33798, 33803, 33928, 33929, 33930, 33931*

**33020 (ORNL-tr—4777) Storage and solidification of MAW/LAW in underground caverns (Phase 2). Studies on product conveyance in fall pipelines. Reporting period, July 1, 1979-December 31, 1979.** (Oak Ridge National Lab., TN (USA)). [nd]. Translation of NUKEM-486 (Appendix 2), February 1980. 38p. NTIS, PC A03/MF A01. Order Number DE81029764.

The work which was carried out during this report period was aimed at determining a favorable fluid concrete mixture from the standpoint of conveyance technology. Spherical, polydisperse pellets were mixed with sand, cement, water, a retardation agent and a liquifier to form a fluid concrete and conveyed downward under the force of their own weight through a vertically suspended pipe. Results obtained with various mixtures are discussed. The following areas are discussed: experimental installation; course of experimentation; production of the mixture; transportation of the concrete to the feed container; conveyance downward; materials used; individual experiments; and summary of the results.

**33021 Evaporative water loss from welded tuff.** Hadley, G.R. (Sandia Lab, Albuquerque, NM). *American Society of Mechanical Engineers, [Paper] ;* **11**: 19-25(1980). (CONF-801102—).

From ASME winter annual meeting; Chicago, IL, USA (16 Nov 1980).

This paper reports the measurement of water loss rate for welded tuff at various temperatures due to the action of evaporative drying. The samples are sections of 4.8 cm diameter core cut to lengths of approximately 6 cm with an average initial water content of about 7% by weight. The samples were weighed and then inserted in a sealed, heated chamber through which dry nitrogen gas was passed at various flow rates. The resulting data show that the water loss rate declines monotonically with time, as expected. All the water loss data is explained to within a factor of two by a simple evaporation front model. 15 refs.

**33022 (DOE/ET/41900—5) Structural damage from fission fragment irradiation in crystalline nuclear waste phases.** Vance, E.R.; Pillay, K.K.S. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 15 Aug 1981. Contract AC09-79ET41900. 39p. (ESG-DOE—13345). NTIS, PC A03/MF A01. Order Number DE81030154.

Approximately 20 candidate phases in ceramic waste forms doped with depleted or enriched uranium were synthesized and then reactor-irradiated for 1 to 100 h. The effects of the resultant fission fragment irradiation ($10^{14}$ to $10^{16}$ fissions.cm$^{-3}$) were studied by powder x-ray diffraction. Oxide phases such as MgO, $\alpha$-$Al_2O_3$, $Fe_2O_3$, $ThO_2$, $Y_2O_3$-stabilized $ZrO_2$, and $Y_2O_3$ showed no observable structural changes at the radiation doses employed. However, perovskite, zirconolite, monazite, huttonite, zircon, and xenotime (all candidate TRU fixers) were amorphized at fission fragment doses of $10^{15}$ to $10^{16}$ cm$^{-3}$, as were rutile and three of four uranates observed as minor phases in the present work (viz, $U_3O_8$, $Sr_2U_3O_{11}$, and $MgUO_4$; $Y_2O_3$ $nUO_3$ [n = 1/3 or 1/6] was not affected). Virtually no effect was observed at (lower) doses of $10^{14}$ fissions.cm$^{-3}$ on $SrMoO_4$, Ba-hollandite, $SrAl_2Si_2O_8$, or $La_8Ca_2(SiO_4)_6O_2$. A spinel phase was rendered nearly amorphous after a dose of $\sim 10^{16}$ fissions.cm$^{-3}$ in a candidate ceramic based on Savannah River plant waste sludge. The significance of these results is discussed from a mechanistic point of view, and the relevance of the results to solidified nuclear wastes is pointed out. It was concluded that fission fragment irradiation is probably not a good simulator of $\alpha$-recoil damage.However, a particular value of the results is that several candidate TRU fixer phases can be amorphized quite easily with fission fragments so that it should be possible to settle the question of the leachability and density differences of crystalline versus radiation-amorphized phases. Preliminary hydrothermal studies indicated that heavy radiation damage of certain materials gives rise to easily observed alteration effects.

**33023 (DOE/RL/10119—1) Hydrologic studies support, INTERCOMP code conversion. Annual report. Research report 80/15-44.** Ichimura, V.I. (Washington State Univ., Pullman (USA). Coll. of Engineering). 16 Oct 1980. Contract AT06-RL10119. 57p. NTIS, PC A04/MF A01. Order Number DE81030318.

The primary cause of mass and energy balance errors noted in IBM executed INTERCOMP code results are due to lack of precision in computing the global values of mass and energy. The correction of this problem has led to improved numerical comparisons between the CDC and IBM computer results. Small differences that exist between the improved INTERCOMP code and CDC results seem unimportant. The differences are greatest at an onset of a physical system perturbation and decrease with succeeding time steps. Good numerical comparison with analytical solutions seem to further prove the authenticity of code results.

**33024 (DOE/UMT—012) Engineering assessment of inactive uranium mill tailings, Naturita Site, Naturita, Colorado.** (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Jul 1981. Contract AC04-76GJ01658. 60p. NTIS, PC A04/MF A01. Order Number DE81030508.

Ford, Bacon and Davis Utah Inc. has reevaluated the Naturita site in order to revise the November 1977 engineering assessment of the problems resulting from the existence of radioactive contamination at the former uranium mill tailings site at Naturita, Colorado. This evaluation has included the preparation of topographic maps, the drilling of boreholes and radiometric measurements sufficient to determine areas and volumes of contaminated materials and radiation exposures of individuals and nearby populations, and the evaluation and costing of alternative remedial actions. Radon gas released from the estimated 344,000 tons of contaminated materials that remain at the Naturita site constitutes the most significant environmental impact, although external gamma radiation also is a factor. The two alternative actions presented in this engineering assessment are stabilization of the site in its present location with the addition of 3 m of stabilization cover material (Option I), and removal of residual radioactive materials to a disposal site and decontamination of the Naturita site (Option II). Cost

estimates for the two options are about $7,200,000 for stabilization in-place, and about $8,200,000 for disposal at the Ranchers Exploration and Development Corporations's reprocessing site. Truck haulage would be used to transport the contaminated materials from the Naturita site to the selected disposal site.Ranchers Exploration and Development Corporation removed the tailings from the site, reprocessed them, and disposed of them from 1977 to 1979. There is no noteworthy mineral resource remaining at the former tailings site; therefore, recovery of residual mineral values was not considered in this assessment.

33025 **(DOE/UMT—012S) Summary of the engineering assessment of inactive uranium mill tailings, Naturita site, Naturita, Colorado.** (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Jul 1981. Contract AC04-76GJ01658. 51p. NTIS, PC A04/MF A01. Order Number DE81030509.

Ford, Bacon and Davis Utah Inc. has reevaluated the Naturita site in order to revise the November 1977 engineering assessment of the problems resulting from the existence of radioactive contamination at the former uranium mill tailings site at Naturita, Colorado. This evaluation has included the preparation of topographic maps, the drilling of boreholes and radiometric measurements sufficient to determine areas and volumes of contaminated materials and radiation exposures of individuals and nearby populations, and the evaluation and costing of alternative remedial actions. Radon gas released from the estimated 344,000 tons of contaminated materials that remain at the Naturita site constitutes the most significant environmental impact, although external gamma radiation also is a factor. The two alternative actions presented in this engineering assessment are stabilization of the site in its present location with the addition of 3 m of stabilization cover material (Option I), and removal of residual radioactive materials to a disposal site and decontamination of the Naturita site (Option II). Cost estimates for the two options are about $7,200,000 for stabilization in-place, and about $8,200,000 for disposal at the Ranchers Exploration and Development Corporation's reprocessing site. Truck haulage would be used to transport the contaminated materials from the Naturita site to the selected disposal site.Ranchers Exploration and Development Corporation removed the tailings from the site, reprocessed them, and disposed of them from 1977 to 1979. There is no noteworthy mineral resource remaining at the former tailings site; therefore, recovery of residual mineral values was not considered in this assessment.

33026 **(DOE/UMT—0104) Engineering assessment of inactive uranium mill tailings, Shiprock site, Shiprock, New Mexico.** (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Jul 1981. Contract AC04-76GJ01658. 204p. NTIS, PC A10/MF A01. Order Number DE81030510.

Ford, Bacon and Davis Utah Inc. has reevaluated the Shiprock site in order to revise the March 1977 engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at Shiprock, New Mexico. This engineering assessment has included the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and radiation exposures of individuals and nearby populations, the investigations of site hydrology and meteorology, and the evaluation and costing of alternative corrective actions. Radon gas released from the 1.5 million dry tons of tailings at the Shiprock site constitutes the most significant environental impact, although windblown tailings and external gamma radiation also are factors. The eight alternative actions presented in this engineering assessment range from millsite decontamination with the addition of 3 m of stabilization cover material (Option I), to removal of the tailings to remote disposal sites and decontamination of the tailings site (Options II through VIII). Cost estimates for the eight options range from about $13,400,000 for stabilization in place to about $37,900,000 for disposal at a distance of about 16 miles. Three principal alternatives for the reprocessing of the Shiprock tailings were examined: (a) heap leaching; (b) treatment at an existing mill; and (c) reprocessing at a new conventional mill constructed for tailings reprocessing. The cost of the uranium recovered would be about $230/lb by heap leach and $250/lb by conventional plant processes. The spot market price for uranium was $25/lb early in 1981. Therefore, reprocessing the tailings for uranium recovery is not economically attractive.

33027 **(DOE/UMT—0104S) Summary of the engineering assessment of inactive uranium mill tailings, Shiprock Site, Shiprock, New Mexico.** (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Jul 1981. Contract AC04-76GJ01658. 58p. NTIS, PC A04/MF A01. Order Number DE81030511.

Ford, Bacon and Davis Utah Inc. has reevaluated the Shiprock site in order to revise the March 1977 engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at Shiprock, New Mexico. This engineering assessment has included the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and radiation exposures of individuals and nearby populations, the investigations of site hydrology and meteorology, and the evaluation and costing of alternative corrective actions. Radon gas released from the 1.5 million dry tons of tailings at the Shiprock site constitutes the most significant environmental impact, although windblown tailings and external gamma radiation also are factors. The eight alternative actions presented in this engineering assessment range from millsite decontamination with the addition of 3 m of stabilization cover material (Option I), to removal of the tailings to remote disposal sites and decontamination of the tailings site (Options II through VIII). Cost estimates for the eight options range from about $13,400,000 for stabilization in place to about $37,900,000 for disposal at a distance of about 16 miles. Three principal alternatives for the reprocessing of the Shiprock tailings were examined: (a) heap leaching; (b) treatment at an existing mill; and(c) reprocessing at a new conventional mill constructed for tailings reprocessing. The cost of the uranium recovered would be about $230/lb by heap leach and $250/lb by conventional plant processes. The spot market price for uranium was $25/lb early in 1981. Therefore, reprocessing the tailings for uranium recovery is not economically attractive.

33028 **(DP-MS—81-18) Effects of high radiation doses on Linde Ion Siv IE-95.** Bibler, N.E.; Wallace, R.M.; Ebra, M.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 21p. (CONF-810814—9). NTIS, PC A02/MF A01. Order Number DE81028380.

From 91. national meeting of the American Institute of Chemical Engineers; Detroit, MI, USA (16 Aug 1981).

The effect of large radiation doses on Linde Ion Siv IE-95 has been investigated. This zeolite material is being considered for removal of Cs-137 from contaminated water. Tests with Co-60 gamma radiation indicated that doses up to $3 \times 10^{10}$ rads had no effect on the crystal structure of the material or on its ability to retain Cs-137. Typical data on the distribution of Cs-137 between the Linde Ion Siv and TMI-2 sump water in terms of (Cs/gram zeolite)/(Cs/mL of solution) were 6170 for unirradiated zeolite, 7100 for zeolite irradiated to $1.1 \times 10^{10}$ rad, and 8390 for zeolite irradiated to $3 \times 10^{10}$ rad. Radiolytic gas production was also investigated. $H_2$ and $O_2$ were produced by radiolytic decomposition of the water in the zeolite. Pressures in excess of 20 psig were attained with air dried zeolite irradiated to a dose of $1.3 \times 10^9$ rad. The rate of pressurization decreased with increasing pressure but a steady state pressure was not achieved at this dose. Drying the zeolite decreased $H_2$ production and caused $O_2$ to be absorbed during the radiolysis.

33029 **(DPST—81-262) Workshop on seismic performance of underground facilities.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 11 Feb 1981. Contract AC09-76SR00001. 107p. NTIS, PC A06/MF A01. Order Number DE81025589.

Separate abstracts were prepared for the nine papers that are included. (DLC)

33030 (DPST—81-262, pp 14p, Paper 3) **Numerical modeling of earthquake effects on underground tunnels.** Wahi, K.K. (Science Applications, Inc./CSI, Albuquerque, NM). 1981. NTIS, PC A06/MF A01.

In Workshop on seismic performance of underground facilities, February 11-13, 1981, Augusta, Georgia.

The two-dimensional version of the STEALTH codes was used. Three different rock types (salt, granite, shale) were consid-

ered as host media for a simple-level radwaste repository 600 m deep. Criteria for failure, damage, and permeability enhancement were defined. Generic shale was found to be an incompetent rock for radwaste storage at 600 m depth. 5 tables. (DLC)

33031 (DPST—81-262, pp 7p, Paper 6) **Developing seismic design criteria.** Owen, G.N. (URS/John A. Blume and Associates, San Francisco, CA). 1981. NTIS, PC A06/MF A01.

In Workshop on seismic performance of underground facilities, February 11-13, 1981, Augusta, Georgia.

Existing seismic standards and guides used for the design of licensed nuclear facilities were reviewed to determine if they could be used for the design of repositories. A number of these guides are possibly applicable to the seismic design of the surface structures and equipment of a repository, although some may have to be modified and rewritten. However, none of the standards and guides used for the design of licensed nuclear facilities are applicable to the underground structures of a repository.

33032 (DPST—81-262, pp 11p, Paper 8) **Seismic evaluation of the headframe structure and the cable/hoist system.** Kamil, H. (Engineering Decision Analysis Co., Inc., (EDAC), San Francisco, CA); Kost, G.; Chen, M.C.; Sharpe, R.; Djahanguiri, F. 1981. NTIS, PC A06/MF A01.

In Workshop on seismic performance of underground facilities, February 11-13, 1981, Augusta, Georgia.

The headframe structure and cable/hoist system of the canistered waste facility of a nuclear waste repository were evaluated seismically for two proposed sites. It was concluded that the conceptual headframe design needs to be modified, and that the cable/hoist system is adequate, although the cages, shaft walls, and cables could impact each other. 5 figures. (DLC)

33033 (DPST—81-262, pp 9p, Paper 9) **Earthquake engineering of large underground structures.** Owen, G.N. (URS/John A. Blume and Associates, San Francisco, CA). 1981. NTIS, PC A06/MF A01.

In Workshop on seismic performance of underground facilities, February 11-13, 1981, Augusta, Georgia.

A study was recently completed on earthquake engineering of underground structures. The study identified and evaluated the current state of the art of earthquake engineering of transportation tunnels and other large underground structures. This paper reports some of the findings of that study which most directly relate to seismic considerations of nuclear waste repositories.

33034 **Pre- and post-dumping investigation for inauguration of new low-level radioactive waste dump sites.** Bowen, V.T.; Hollister, C.D. (Woods Hole Oceanographic Institution, Mass). *Radioactive Waste Management (New York) ;* **1**: No. 3, 235-269(Jan 1981).

Onsite research required before dumping of radioactive wastes should cover specific generic criteria (biological, chemical, and geological). Detailed research and monitoring programs and estimate of costs are outlined for pre- and post-dumping situations. Physical and/or chemical effects of solid waste dumping may far outweigh radiobiological effects. Substantial cost savings may be realized by giving special treatment to the small fraction of containers holding most of the radioactive material. (34 references, 1 table)

33035 **(LA—8861-UMT) Biogeochemistry of uranium mill wastes program overview and conclusions.** Dreesen, D.R. (Los Alamos National Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 7p. NTIS, PC A02/MF A01. Order Number DE81032025.

The major findings and conclusions are summarized for research on uranium mill tailings for the US Department of Energy and the US Nuclear Regulatory Commission. An overview of results and interpretations is presented for investigations of $^{222}Rn$ emissions, revegetation of tailings and mine spoils, and trace element enrichment, mobility, and bioavailability. A brief discussion addresses the implications of these findings in relation to tailings disposal technology and proposed uranium recovery processes.

33036 **(LA—8967-PR) NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980.** Evans, M.L. (comp.). (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 16p. NTIS, PC A02/MF A01. Order Number DE81032022.

This report describes work performed during the time period from January 1, 1980, to June 30, 1980, on the contract for Nondestructive Nuclear Analysis Technology for Uranium Resource Evaluation in the Safeguards Technology, International Safeguards, and Training Group, Q-1, at Los Alamos National Laboratory. The calculational effort was concentrated on the development of a generalized computer model to simulate the emission, transport, and detection of natural gamma radiation from various logging environments. The model yields accurate high-resolution gamma-ray pulse-height spectra that can be used to correct both gross gamma-ray and spectral gamma-ray logs. The experimental effort focused on the analytical chemistry assay of a series of crushed concrete samples ten from the Department of Energy (DOE) Grand Junction calibration models used to calibrate logging tools employing active neutron interrogation techniques. The results establish the levels of neutron poisons in the test pits. In addition, the outfitting of a Bendix Field Engineering Corporation/DOE logging truck for the field testing of the photoneutron probe is described, as is a sodium iodide passive gamma-ray probe used to verify the absence of obstructions in a borehole and to locate uranium-bearing ore zones.

33037 **(LA-UR—81-2584) Importance of creep failure of hard rock in the near field of a nuclear-waste repository.** Blacic, J.D. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 10p. (CONF-810861—2). NTIS, PC A02/MF A01. Order Number DE81030242.

From OECD Nuclear Energy Agency workshop on near-field phenomena in geologic respositories for radioactive waste; Seattle, WA, USA (31 Aug 1981).

Potential damage resulting from slow creep deformation intuitively seems unlikely for a high-level nuclear waste repository excavated in hard rock. However, recent experimental and modeling results indicate that the processes of time-dependent microcracking and water-induced stress corrosion can lead to significant reductions in strength and alteration of other key rock properties in the near-field region of a repository. We review the small data base supporting these conclusions and stress the need for an extensive laboratory program to obtain the new data that will be required for design of a repository.

33038 (LBL—11566, pp 37-42) **Example of rock fracture characterization for modeling purposes.** Thorpe, R.K. (Lawrence Berkeley Lab., CA). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

The spatial definition of geologic discontinuities in a rock mass is an important part of the modeling process. This paper illustrates the type of observational information available to the analyst and how it can be developed. The example for the discussion is the characterization of natural fracturing around the Time-Scale Heater Experiment at the Stripa Mine in south-central Sweden. This experiment is one of several field tests in the Swedish-American Cooperative Waste Storage Research Program that focus on the thermomechanical aspects of potential nuclear waste storage in crystalline rock. It is intended that the information presented here will be incorporated into numerical models of the local rock mass in the future.

33039 **(ONWI—9-81-2) Technical progress report for the quarter, 1 January-31 March 1981.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1981. Contract AC06-76RL01830. 261p. NTIS, PC A12/MF A01. Order Number DE81030389.

This report describes the technical accomplishments on the commercial nuclear waste management programs under the direction of the Office of Nuclear Waste Isolation (ONWI). The scope of ONWI activities includes providing the technology and facilities for the terminal isolation of nuclear wastes by disposal in mined repositories deep underground in geologic formations. Steps leading

to the accomplishement of that purpose include: site exploration, characterization, and recommendation; design, licensing, construction, and operation of a commercial geologic repository; technology development to support these steps. The ONWI program is organized into the following eight tasks: systems; waste package; site; repository; regulatory and institutional; test facilities and excavations; land acquisition; and program management.

33040 **(PNL—3902) Stability of multilayer earthen barriers used to isolate mill tailings: geologic and geotechnological considerations.** Zellmer, J.T. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Aug 1981. Contract AC06-76RL01830. 49p. NTIS, PC A03/MF A01. Order Number DE81028403.

This report briefly discusses how seismic activity, erosion, climatic change, slope stability, differential settlement, and cover design could affect the long-term integrity of multilayer earthen cover systems. In addition, the report suggests ways to design and construct covers so that adverse impacts can be avoided or minimized. The stability of multilayer earthen barriers used to isolate uranium mill tailings depends on the morphology of the disposal site, the engineering of the barrier, the condition of the tailings, and the possible impacts of earthquakes, erosion, and climatic changes. When designing a cover for or siting a tailings pile, one must take into account both geologic and geotechnological variables. To alleviate the adverse effects of possible seismic activity, tailings piles should never be located on or near active or capable faults. Existing piles near faults should be moved to safer sites or engineered to withstand possible displacement and shaking. Liquefaction generally can be prevented if the tailings and their underlying material are compacted to a relative density of 60% or greater, or if they are kept dry. If the tailings are saturated, dewatering schemes may have to be used. Erosion may be caused by streams, glaciers, or wind, depending on the geomorphic and atmospheric conditions at the site. Fluvial erosion can be prevented by using dikes (and avoided by initially siting the pile a safe distance away from stream courses). In some cases, fluvial waters or rainfall may have to be rerouted over the pile via armored ditches. Eolian erosion can be minimized by vegetating the disposal site or covering it with gravel. Because of the wide geomorphic and geotechnological variations extant at most sites, a single cover design cannot be cost-effectively and efficiently used at all sites.

33041 **(PNL—3948) Fracturing of simulated high-level waste glass in canisters.** Peters, R.D.; Slate, S.C. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Sep 1981. Contract AC06-76RL01830. 58p. NTIS, PC A04/MF A01. Order Number DE81030621.

Waste-glass castings generated from engineering-scale developmental processes at the Pacific Northwest Laboratory are generally found to have significant levels of cracks. The causes and extent of fracturing in full-scale canisters of waste glass as a result of cooling and accidental impact are discussed. Although the effects of cracking on waste-form performance in a repository are not well understood, cracks in waste forms can potentially increase leaching surface area. If cracks are minimized or absent in the waste-glass canisters, the potential for radionuclide release from the canister package can be reduced. Additional work on the effects of cracks on leaching of glass is needed. In addition to investigating the extent of fracturing of glass in waste-glass canisters, methods to reduce cracking by controlling cooling conditions were explored. Overall, the study shows that the extent of glass cracking in full-scale, passively-cooled, continuous melting-produced canisters is strongly dependent on the cooling rate. This observation agrees with results of previously reported Pacific Northwest Laboratory experiments on bench-scale annealed canisters. Thus, the cause of cracking is principally bulk thermal stresses. Fracture damage resulting from shearing at the glass/metal interface also contributes to cracking, more so in stainless steel canisters than in carbon steel canisters. This effect can be reduced or eliminated with a graphite coating applied to the inside of the canister. Thermal fracturing can be controlled by using a fixed amount of insulation for filling and cooling of canisters. In order to maintain production rates, a small amount of additional facility space is needed to accomodate slow-cooling canisters. Alternatively, faster cooling can be achieved using the multi-staged approach. Additional development is needed before this approach can be used on full-scale (60-cm) canisters.

33042 **Nuclear waste isolation.** Bateman, W. (DOE, USA). *Combustion ;* **51**: No. 12, 15-20(Jun 1980).

A description is given of a geologic repository program. Other federal waste disposal initiatives are also examined.

33043 **Possibility of multiple temperature maxima in geologic repositories for spent fuel from nuclear reactors.** Beyerlein, S.W.; Claiborne, H.C. (Oak Ridge Natl Lab, Tenn). *American Society of Mechanical Engineers, [Paper] ;* **11**: 49-57(1980). (CONF-801102—).

From ASME winter annual meeting; Chicago, IL, USA (16 Nov 1980).

Heat transfer studies for CANDU spent fuel repositories showed that two temperature maxima at the disposal horizon could occur between one near 60 years, and another one at 13,000 years. Because CANDU spent fuels display a monotonically decreasing heat generation rate, it is not immediately obvious why such behavior occurs. This paper demonstrates that the "double peak" phenomenon is due to the presence of the right mixture of short- and long-lived nuclides in the fuel and the second peak disappears for repository sizes less than about 1 square kilometer. For larger repositories, radial and surface heat transfer reduces the magnitude of the second peak. Spent fuel from pressurized water reactors did not produce a double temperature peak even for the infinite plane source model. The differences result because of the different amount and distribution of transuranic elements and isotopes. 8 refs.

33044 **Effects of annular air gaps surrounding an emplaced nuclear waste canister in deep geologic storage.** Lowry, W.E.; Davis, B.W.; Cheung, H. (Lawrence Livermore Lab, Calif). *American Society of Mechanical Engineers, [Paper] ;* **11**: 69-75(1980). (CONF-801102—).

From ASME winter annual meeting; Chicago, IL, USA (16 Nov 1980).

Annular air spaces surrounding an emplaced nuclear waste canister in deep geologic storage will have significant effects on the long-term performance of the waste form. Addressed specifically in this analysis is the influence of a gap on the thermal response of the waste package. Three dimensional numerical modeling predicts temperature effects for a series of parameter variations, including the influence of gap size, surface emissivities, initial thermal power generation rate of the canister, and the presence/absence of a sleeve. Particular emphasis is placed on determining the effects these variables have on the canister surface temperature. 9 refs.

33045 **Low-level waste management.** Oertel, G.K. (Off of Nucl Waste Manage). pp vp of Atomic Industrial Forum, Inc., fuel cycle conference, 1980. Bethesda, MD; Atomic Industrial Forum, Inc. (1980).

From Fuel cycle conference; New Orleans, LA, USA (15 Apr 1980).

A snapshot view is presented of the rapidly developing National scene in low-level radioactive waste management and an approach is described that can be implemented most effectively. The paper further details the assumptions upon which the approach is based, ways to implement it, options for dealing wih near-term needs in the interim, costs, and perceived shortcomings f the commercial sector. The impact of inflation on "perpetual care" is analyzed in an appendix.

## 0530 Environmental Aspects

*REFER ALSO TO CITATION(S) 33024, 33025, 33026, 33027, 33034, 33767, 33777, 33788, 33800, 33804, 33889, 33928*

33046 **(K/SUB—13876-81/1) Measurement of outdoor noise levels adjacent to K-25 facility, ORGDP.** Rodman, C.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA); Battelle Columbus Labs., OH (USA)). 27 Aug 1981. Contract W-7405-ENG-26. 30p. NTIS, PC A03/MF A01. Order Number DE81029526.

In order to obtain baseline data on environmental sound for a report on the expected environmental effects of constructing an incinerator adjacent to the ORGDP, an abbreviated measurement program was carried out. Ten measurement locations were selected for the measurements, six being representative of the ORGDP fen-

celine, and four representative of the surrounding area. Measurements consisted of short-term octave-band measurements and one-half hour A-weighted exceedance levels. It had been previously determined that the influence of the K-25 plant on the noise environment tends to stabilize the minimum sound level in such a way that nighttime measurements would not be needed.

33047 **(LBL—11566) Proceedings of the workshop on numerical modeling of thermohydrological flow in fractured rock masses.** (Lawrence Berkeley Lab., CA (USA)). Sep 1980. Contract W-7405-ENG-48. 130p. (CONF-800267—). NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

Nineteen papers were presented at the workshop on modeling thermohydrologic flow in fractured masses. This workshop was a result of the interest currently being given to the isolation of nuclear wastes in geologic formations. Included in these proceedings are eighteen of the presentations, one abstract and summaries of the panel discussions. The papers are listed under the following categories: introduction; overviews; fracture modelings; repository studies; geothermal models; and recent developments. Eighteen of the papers have been abstracted and indexed.

33048 (LBL—11566, pp 3-13) **Introduction to numerical modeling of thermohydrologic flow in fractured rock masses.** Wang, J.S.Y. (Lawrence Berkeley Lab., CA). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

More attention is being given to the possibility of nuclear waste isolation in hard rock formations. The waste will generate heat which raises the temperature of the surrounding fractured rock masses and induces buoyancy flow and pressure change in the fluid. These effects introduce the potential hazard of radionuclides being carried to the biosphere, and affect the structure of a repository by stress changes in the rock formation. The thermohydrological and thermomechanical responses are determined by the fractures as well as the intact rock blocks. The capability of modeling fractured rock masses is essential to site characterization and repository evaluation. The fractures can be modeled either as a discrete system, taking into account the detailed fracture distributions, or as a continuum representing the spatial average of the fractures. A numerical model is characterized by the governing equations, the numerical methods, the computer codes, the validations, and the applications. These elements of the thermohydrological models are discussed. Along with the general review, some of the considerations in modeling fractures are also discussed. Some remarks on the research needs in modeling fractured rock mass conclude the paper.

33049 (LBL—11566, pp 14-15) **UK modelling of thermal effects on leakage from hard rock depositories.** Bourke, P.J. (Harwell Lab., Oxford, England). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

Thermally induced stress through and around depositories have been calculated assuming the rock to have constant mechanical properties obtained from laboratory measurements and ignoring the effects of existing fractures. After allowing for probable values of the natural stress field, regions of net tension and high shear stress which might cause new fractures were found. This analysis is, however, not yet considered to be reliable because of uncertainty about the above assumptions. Further, even if it is accurate, it is incomplete because it is still not possible to relate quantitatively calculated stresses to changes in permeability and porosity due to changes in existing fractures or initiation of new ones. Accordingly, further theoretical work is being done to plan an underground study of the effects of heating on a well defined fracture. Measurements of strain and modulus will be made to investigate the validity of the mechanical assumptions and hydraulic data will be obtained to relate stress to resistance to flow. It is hoped that further analysis will then allow an assessment of the importance of thermal stress around a depository to be made.

33050 (LBL—11566, pp 16-32) **Multidimensional numerical simulation of fluid flow in fractured porous media.** Narasimhan, T.N. (Lawrence Berkeley Lab., CA). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

Fluid flow in fractured porous media can be simulated with considerable ease and generality using an integral finite-difference scheme (IFDM). The three commonly used conceptualizations of fractured systems, namely, discrete fracture systems, equivalent porous media systems, and double- or composite-porosity systems are all contained within the IFDM formulation. The theoretical basis of the IFDM is briefly described and the method is compared and contrasted with the finite difference and the finite element methods. Six illustrative examples are provided to demonstrate the applicability of the method to fractures with fixed or variable geometry, to advective-diffusive chemical transport in a fractured system and to a double-porosity system.

33051 (LBL—11566, pp 33-36) **Flow in fractured porous media.** Duguid, J.O. (Battelle Memorial Inst., Columbus, OH). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

The equations governing fluid flow through fractured porous media consist of two equations of motion and two continuity equations. These equations are coupled by an interaction term that represents the mass flux of fluid from the primary pores into the fractures. Numerical (finite element) solution of the governing equations was used to investigate the relative magnitude of some of the terms of the equations. The acceleration term in the equation of motion for the fractures was found to be small and for the cases investigated can be neglected. Elimination of this acceleration term allows the governing equations to be greatly simplified, a simplification that allows for the numerical solution of the governing equations on a larger region.

33052 (LBL—11566, pp 50-59) **Porous media fluid flow, heat, and mass transport model with rock stress coupling.** Runchal, A.K. (Analytic and Computational Research, Inc., Los Angeles, CA). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

This paper describes the physical and mathematical basis of a general purpose porous media flow model, GWTHERM. The mathematical basis of the model is obtained from the coupled set of the classical governing equations for the mass, momentum and energy balance. These equations are embodied in a computational model which is then coupled externally to a linearly elastic rock-stress model. This coupling is rather exploratory and based upon empirical correlations. The coupled model is able to take account of time-dependent, inhomogeneous and anisotropic features of the hydrogeologic, thermal and transport phenomena. A number of applications of the model have been made. Illustrations from the application of the model to nuclear waste repositories are included.

33053 (LBL—11566, pp 77-85) **Description and applications of the FE3DGW and CFEST three-dimensional finite-element models.** Gupta, S.K.; Cole, C.R.; Kincaid, C.T.; Kaszeta, F.E. (Pacific Northwest Lab., Richland, WA). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

The FE3DGW model is a finite-element three-dimensional isothermal saturated ground-water flow model for simulation of potentials, flow paths, and travel time in a complex multilayered system. The model has been used for regional ground-water basin studies and generic studies involving fracture flow as an equivalent porous media. The CFEST (Coupled Flow, Energy, and Solute

Transport) model is an extension of FE3DGW to address the problems in areas of seasonal energy storage in aquifers, disposal of chemical wastes in aquifers, storage of fresh water in saline aquifers, and salt-water intrusion into fresh ground-water flow systems. The model solves the partial differential equations describing single-phase fluid flow, energy transport by conduction and convection, and solute transport by dispersion, diffusion and convection.

33054 (LBL—11566, pp 115-116) **Importance of including fractures in thermohydrological modeling of flow through porous media.** Eaton, R.R.; Larson, D.E. (Sandia National Labs., Albuquerque, NM). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

This paper shows that computational models used to analyze the thermal and hydrologic characteristics of a nuclear waste repository site can give unrealistic results if the porous material matrix containing the repository is assumed fracture-free and completely rigid. Numerically modeling a repository in a homogenous porous media with an assumed permeability of $10^{-7}$ darcy results in calculated pore pressures which are four times larger than the local lithostatic load. These extreme pressures would degrade the integrity of most rock. It is concluded that the characteristics of the fractures within the material matrix must be considered in the computational model in order to obtain realistic results.

33055 **(UCRL—85553) Predictive calculations of volatilities of metals and oxides in steam-containing environments.** Krikorian, O.H. (Lawrence Livermore National Lab., CA (USA)). 10 Aug 1981. Contract W-7405-ENG-48. 28p. (CONF-810943—1). NTIS, PC A03/MF A01. Order Number DE81029638.

From Conference on chemistry of materials at high temperatures; Harwell, Oxfordshire, UK (7 Sep 1981).

Predictive methods are developed for estimating the bond energies and free energy functions of volatile species having the general formula MO/sub x/ (OH)/sub y/, in order to shed some light on the mechanisms and extent of steam accelerated volatilization processes. A specific example of applying the data is illustrated for the case of a proposed underground radioactive waste disposal process, where oxides of radionuclides are allowed to equilibrate with 100 atm steam and $10^{-2}$ atm oxygen at 1000 to 2000K. Vapor species found to have high volatilities include $Cs_2(OH)_2$, $CsOH$, $AmO_2(OH)_2$, $AmO(OH)_3$, $UO_2(OH)_2$, $NbO(OH)_3$, $PuO_2(OH)_2$, $CeO(OH)_2$, $Ba(OH)_2$, and $Eu(OH)_3$. Thermodynamic data are tabulated for all possible monomeric species for this specific example.

## 0540 Health And Safety

*REFER ALSO TO CITATION(S) 33768*

33056 **(PNL—3791) Factors affecting criticality for spent-fuel materials in a geologic setting.** Gore, B.F.; Jenquin, U.P.; Serne, R.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1981. Contract AC06-76RL01830. 210p. NTIS, PC A10/MF A01. Order Number DE81029275.

Following closure of a geologic repository for spent fuel, geologic process may change geometries and spacings, and water may enter the repository. In this study the conditions required for the criticality of spent fuel constituents are determined. Many factors affect criticality, and the effects of various possible post-closure changes are investigated. Factors having the greatest effect on criticality are identified to provide guidance for research programs and for design and evaluation studies. Section II describes the calculational methods and computer codes used to determine critical conditions. Section III of this document addresses effects of the fissile content of spent fuel on criticality. Calculations have been performed to determine the minimum critical mass of spent fuel actinides as a function of the duration of in-reactor fuel exposure for a variety of possible conditions. Section IV addresses the conditions required for criticality under a scenario believed to be highly unlikely but having a unique possibility. Pu quantities and concentrations required for criticality without water were determined for various conditions of Pu separation, rock moderation and reflection, rock impurities and isotopic content of the Pu. Section V addresses the possibility of geochemical processes separating Pu from other spent fuel constituents. Solubilities of U and Pu are calculated for groundwaters characteristic of basalt, tuff, granite, bedded and dome salt. Maximum concentrations which could be adsorbed on geologic media in contact with these groundwaters are then calculated. Comparison of these maximum adsorbed concentrations with the results presented in Section IV yields the conclusion that criticality cannot occur in sorbed deposits of Pu in geologic media due to the low Pu concentrations achievable. The possibility of selective Pu precipitation, however, is not ruled out by these arguments.

33057 **(PNL-SA—9262) Radiological planning guide for DOE decommissioning operations.** Denham, D.H. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1981. Contract AC06-76RL01830. 30p. (CONF-8106144—5). NTIS, PC A03/MF A01. Order Number DE81030083.

From Health Physics Society annual meeting; Louisville, KY, USA (21 Jun 1981).

This Guide is intended to promote the efficient and uniform decommissioning of the many DOE nuclear facilities and sites whose missions are complete. Since it is imperative that a consistent set of criteria and methodologies be applied to all DOE decommissioning operations, this guide attempts to provide that framework through an integrated systems approach in which all factors interact. Decommissioning is assumed to include three major phases: site characterization, remedial action, and certification. This paper discusses the PNL efforts to date in developing the draft Guide, emphasizing the need for: (1) an overall management team with expertise in health physics, statistics, instrumentation and quality assurance; (2) design objectives based on ALARA; (3) selection of de minimis criteria; and (4) a methodical records search and statistically based surveys to estimate residual radionuclide inventories, and to provide a basis for additional surveys, survey instrument requirements, dose estimates, and appropriate protective measures.

## 0550 Regulations

*REFER ALSO TO CITATION(S) 33290, 33576*

33058 **Safeguards design for a plutonium concentrator: an applied estimation approach.** Candy, J.V.; Rozsa, R.B. (Univ. of California, Livermore). *Automatica ;* **16**: No. 6, 615-627(1980).

In this paper we consider the design of a nonlinear estimator to be used in conjunction with on-line detectors for a plutonium nitrate concentrator. Using a complex state-of-the-art process model to simulate realistic data, we show that the estimator performance using a simplified process model is adequate over a wide range of operation. The estimator is used to simulate and characterize some on-line diversion detectors, i.e. detectors designed to indicate if some of the critical special nuclear material in process is stolen or diverted from the unit. Simulation results indicate that the estimators and detectors yielded reasonable performance for the scenarios investigated. 12 figures, 4 tables.

33059 **(IS-M—337) Application of ICP-AES to the multielemental and multi-isotopic analysis of fuel dissolver solutions. Progress report.** Edelson, M.C.; Fassel, V.A. (Ames Lab., IA (USA)). Jul 1981. Contract W-7405-ENG-82. 20p. (CONF-810738—3). NTIS, PC A02/MF A01. Order Number DE81029615.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

The authors state that their study is still in its early stages and that they cannot at this time state categorically that inductively coupled plasma-atomic emission spectroscopy (ICP-AES) can provide on-line, near real-time analyses of dissolver solutions. They need to verify the performance of the ICP in intense radioactive environments, Pu spectra must be obtained, and suitable internal reference elements determined. At this time they can say that their work to-date is promising and that they are optimistic regarding the application of ICP-AES to the problems of safeguards analysis.

33060 **(LA—8621-MS) Application of the active well coincidence counter (AWCC) to high-enrichment uranium metal.** Menlove, H.O.; Bosler, G.E. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-4705-ENG-36. 44p. NTIS, PC A03/MF A01. Order Number DE81030503.

The Active Well Coincidence Counter has been evaluated for the assay of high-enrichment uranium metal samples. Samples of interest to the International Atomic Energy Agency (IAEA), including stacked disks to simulate buttons and thin metal plates, were measured. Both thermal-neutron and fast-neutron interrogation modes were evaluated to extend the measurement range from a few grams to several kilograms of $^{235}U$. Neutron self-shielding and multiplication effects were studied, and measurement and calibration procedures have been developed for the AWCC. The results demonstrated that the instrument can be used for the assay of a wide range of high-enrichment uranium samples.

33061 **(LA—8969-MS) Some political issues related to future special nuclear materials production.** Peaslee, A.T. Jr. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 21p. NTIS, PC A02/MF A01. Order Number DE81030852.

The Federal Government must take action to assure the future adequate supply of special nuclear materials for nuclear weapons. Existing statutes permit the construction of advanced defense production reactors and the reprocessing of commercial spent fuel for the production of special materials. Such actions would not only benefit the US nuclear reactor manufacturers, but also the US electric utilities that use nuclear reactors.

33062 **(SAND—81-1051) Evaluation of active and passive near-millimeter-wave radiometric imaging techniques for detection of concealed objects.** Reber, E.E.; Foote, F.B.; Schellenbaum, R.L.; Bradley, R.G. (Sandia National Labs., Albuquerque, NM (USA); Aerospace Corp., Los Angeles, CA (USA)). Jul 1981. Contract AC04-76DP00789. 21p. NTIS, PC A02/MF A01. Order Number DE81031938.

Active and passive radiometric imaging techniques have been used at 1.4- and 3-mm wavelengths (220 and 100 GHz) to evaluate their potential use in detecting concealed objects. An evaluation of the techniques includes a particular study of their potential in detecting shielded nuclear materials and explosives carried covertly by personnel. We have previously reported images of metal objects and nuclear shielding materials that were detected when concealed under clothing. These images appear with the human body as background. Detection of contraband by radiometric imaging techniques depends upon the differences in emissivity and reflectivity of the contraband relative to human tissue. Explosives, unlike metals and metal composites, generally have high emissivities and low reflectivities that closely approximate those of human tissue making explosives difficult to detect. Samples of several common types of explosives (TNT, Detasheet, C4, and several types of water gels) have been examined at the 1.4- and 3-mm wavelengths using active and passive radiometric techniques.

# 06 FUSION FUELS

## 0602 Processing

33063 (CONF-801011—(Vol.1), pp 167-172) **Calculations of DT fill times and time-temperature behavior during injection for some representative ICF pellets.** DelVecchio, R.M.; Holland, J.R. (Westinghouse Research and Development Center, Pittsburgh, PA). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Commercial ICF pellets are likely to consist of concentric spherical shells, the innermost one containing a solid layer of DT. We obtain estimates of the time required to fill the inner shell with DT by means of gaseous diffusion by numerically solving the diffusion equation. In addition, the mathematically similar thermal diffusion equation is solved to determine whether the DT remains solid during the time the pellet spends in the reaction chamber before ignition. The boundary condition for the thermal problem contains both convective and radiative heat transfer contributions. We present the mathematical procedure in general terms, obtaining numerical results for some special choices of pellet configurations and dimensions.

## 0603 By-products

33064 (CONF-801011—(Vol.2), pp 1622-1629) **Design considerations for high-temperature synthetic fuel production fusion reactors.** Cheng, E.T. (General Atomic Co., San Diego, CA); Wong, C.P.C.; McCorkle, K.H. Jr.; Trester, P.W.; Schultz, K.R.; Goodrich, R.; Jensen, B. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The design considerations were explored for the adaptation of the high-temperature General Atomic sulfur-iodine thermochemical water splitting cycle to a fusion reactor heat source. The analyses showed that the fraction of fusion energy that can be delivered to the chemical process at high temperature is independent of the reactor type and depends only on the blanket design. The high-temperature cycle modification was found to have a good heat line match to the fusion heat source with an attractive possibility of process simplification compared to the reference HTGR-adapted cycle. The cost improvement due to the modification is potentially 15 to 30% lower than in the HTGR cycle. In designing such a synfuel reactor, the tritium breeding and handling concerns, materials compatibility, heat removal and radioactivity contamination of the hydrogen product and chemical processes are among the potential problem areas investigated. Viable design approaches were identified for each problem area and constitute the basis for a comprehensive conceptual synfuel fusion reactor design study.

33065 **(UCRL—86600) Hydrogen production based on magnetic fusion.** Krikorian, O.H. (Lawrence Livermore National Lab., CA (USA)). 17 Aug 1981. Contract W-7405-ENG-48. 7p. (CONF-810942—1). NTIS, PC A02/MF A01. Order Number DE81029636.

From International Energy Agency Annex I workshop on thermochemical hydrogen; Julich, F.R. Germany (23 Sep 1981).

Aspects of the work that are reported are (1) a brief summary of the status of TMR blanket design studies as an energy source for thermochemical cycles, (2) a joule-boosted decomposer concept for $SO_3$ decomposition, and (3) some of the details of the thermodynamics of boiling of the $H_2SO_4$ azeotrope and the enthalpy of the resulting vapor as a function of temperature.

## 0607 Waste Management

33066 (CONF-801011—(Vol.2), pp 1306-1315) **Potential for lessened waste hazards from the thorium cycle by means of fusion symbiosis.** Sheff, J.R.; Martin, J.G. (Univ. of Lowell, MA). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

After several hundred years of storage, the radioactive wastes from various nuclear cycles differ considerably in isotopic composition. Earlier studies on all-fission systems conclude that the differences do not constitute a strong incentive for choosing any particular cycle. The U-233 for fueling thorium based converters may be produced in D-T fusion driven factories: symbiotic schemes have some interesting advantages from the point of view of economics, safeguards, and extension of fuel utilization. Here, preliminary evidence suggests that the long-term toxicity of the waste from symbiotic cycles may be considerably lower than that of the waste from plutonium cycles or thorium cycles which use U-235 or Pu as make-up feed.

33067 (CONF-801011—(Vol.2), pp 1643-1650) **Long-term toxicity reduction using an imploding liner reactor as a waste transmuter.** Davidson, J.W.; Parish, T.A. (Univ. of Texas, Austin). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A model for a transmutation based waste management system was developed. This system incorporates chemical processing of HLW to recover waste nuclides to be irradiated with neutrons in a transmutation device. The transmuter periodically requires replenishment of the target nuclides and chemical processing to remove the transmutation products. The waste streams from HLW processing and product recovery together comprise the discharge from the system. An imploding liner fusion reactor (ILFR) is assumed as the transmuter with the waste nuclides dissolved in a molten lead-lithium alloy blanket. Blanket feed and product removal processing are assumed to be continuous with the target and product nuclide concentrations in the blanket taken as equilibrium values.

# 07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

33068 **(PNL—3839) List of DOE radioisotope customers with summary of radioisotope shipments, FY 1980.** Burlison, J.S. (comp.). (Battelle Pacific Northwest Labs., Richland, WA (USA)). Aug 1981. Contract AC06-76RL01830. 52p. NTIS, PC A04/MF A01. Order Number DE81030185.

The sixteenth edition of the radioisotope customer list was prepared at the request of the Office of Health and Environmental Research, Office of energy Research, Department of Energy (DOE). This document lists DOE's radioisotope production and distribution activities by its facilities at Argonne National Laboratory; Pacific Northwest Laboratory; Brookhaven National Laboraory; Hanford Engineering Development Laboratory; Idaho Operations Office; Los Alamos Scientific Laboratory; Mound Facility; Oak Ridge National Laboratory; Savannah River Laboratory; and UNC Nuclear Industries, Inc. The information is divided into five sections: (1) isotope suppliers, facility, contracts and isotopes or services supplied; (2) alphabetical list of customers, and isotopes purchased; (3) alphabetical list of isotopes cross-referenced to customer numbers; (4) geographical location of radioisotope customers; and (5) radioisotope sales and transfers-FY 1980.

## 0702 Radiation Sources

33069 **(GEPP-TIS—587) Aging of Adiprene L-100/butanediol/trimethylolpropane stocks.** Creed, K.E.; Gillespie, T.J.; Sayre, J.A. (General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.). 31 Aug 1981. Contract AC04-76DP00656. 38p. NTIS, PC A03/MF A01. Order Number DE81030694.

Electrical problems in a neutron generator initiated a study of the aging characteristics of the polyurethane/butanediol/trimethylolpropane system. Judging from adhesion measurements and a tensile strength/elongation ratio (S/E), material that was shelf-aged from 1970 through 1976 still had high adhesion (90 lb/in.$^2$) and excellent flexibility (65 S/E). From 1979 through 1980, parameters decayed rapidly displaying 44 lb/in.$^2$ adhesion and 92 S/E with 28 percent zero adhesion. Under normal storage, material adhesion deteriorated to 0 lb/in.$^2$ in 25 to 27 weeks, while at 95 percent relative humidity adhesion deteriorated to 0 lb/in.$^2$ in just six weeks. Moisture was pinpointed as the causative agent. To assess product reliability, accelerated aging tests were initiated to obtain the activation energy of aging, which was found to be 30.6 kcal/mole. Based on this, air oven aging for 23 days at 60°C would provide aging equivalent to 20 years at 23°C. Evaluation of this is in progress. To protect the system from moisture effects, a silane adhesion promoter was added in one percent quantities. This provided a nominal adhesion of 130 lb/in.$^2$ and an S/E value of 23. Over a seven month aging period at 95 percent relative humidity, adhesion improved by 50 percent. The physical, electrical and outgassing characteristics of the silane stock was equivalent to the polyurethane control. For comparison purposes, and to set up conditions for evaluation of the silane system, a program was initiated to determine the aging activation energy using normal air oven aging and aging at various humidity levels.

## 0703 Isotopic Power Supplies

*REFER ALSO TO CITATION(S) 33536*

33070 **(DPST—80-128-4) $^{238}$Pu fuel form processes. Quarterly report, October-December 1980.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Aug 1981. Contract AC09-76SR00001. 52p. NTIS, PC A04/MF A01. Order Number DE81030522.

Goals of the Savannah River Laboratory (SRL) program include providing technical support for the production of $^{238}PuO_2$ fuel forms in the Savannah River Plant's (SRP) Plutonium Fuel Form (PuFF) Facility. Progress is reported including studies on the impact response of SRP MHW $^{238}PuO_2$ fuel spheres. The iridium containment shell of an encapsulated SRP fuel sphere, Multi-hundred Watt Fuel Test (MHFT) 65 split open during a Safety Verification Impact Test (SVT), and about 2 g of $^{238}PuO_2$ was released. (Typical oxide releases in previous tests were 1 to 10 mg). The cause of the impact failure was investigated. Also, the feasibility of using a direct fabrication process to produce full-scale GPHS fuel pellets has been demonstrated. (WHK)

33071 **(LA—8904-PR) Space nuclear safety and fuels program. Progress report.** Bronisz, S.E. (comp.). (Los Alamos National Lab., NM (USA)). Jun 1981. Contract W-7405-ENG-36. 17p. NTIS, PC A02/MF A01. Order Number DE81030501.

The studies related to the use of $^{238}PuO_2$ in radioisotopic power system carried out for the Space and Terrestrial Systems Division of the US Department of Energy by the Los Alamos National Laboratory are reported.

33072 **(LA—8968-PR) Space nuclear safety and fuels program. Progress report, April 1981.** Bronisz, S.E. (Los Alamos National Lab., NM (USA)). Jul 1981. Contract W-7405-ENG-36. 14p. NTIS, PC A02/MF A01. Order Number DE81030504.

The studies related to the use of $^{238}PuO_2$ in radioisotope power systems carried out for the Office of Coordination and Special Projects of the US Department of Energy by the Los Alamos National Laboratory in April 1981 are reported. Impact testing, module handling procedures, and non-destructive test data for encapsulated pellets are reported. (WHK)

# 08 HYDROGEN

## 0801 Production

*REFER ALSO TO CITATION(S) 32850, 32850, 33064, 33065, 33596*

33073 **(LA-UR—81-2477) Oxidation of metal sulfites by iodine for use in thermochemical hydrogen cycles.** Mason, C.F.V.; Bowman, M.G. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810942—5). NTIS, PC A02/MF A01. Order Number DE81030253.

From International Energy Agency Annex I workshop on thermochemical hydrogen; Julich, F.R. Germany (23 Sep 1981).

Thermochemical hydrogen cycles involving metal sulfates offer an alternative to sulfuric acid which is corrosion and has high energy requirements for drying prior to its thermal decomposition. The formation of such metal sulfates in conjunction with a low-temperature hydrogen formation step is discussed. The following reaction was studied: $MgSO_3(c) + MgO(c) + I_2(g) \rightarrow MgSO_4(c) + MgI_2(c)$. Although magnesium sulfite appears promising for this oxidation, a search was conducted for alternative metal sulfites which fit the following criteria for use: (a) sulfate must decompose in the temperature range available ($< 1400°K$); (b) iodide must hydrolyze easily; and (c) salts must not be rare, toxic, or expensive. Lanthanum and titanium fit these criteria and will be investigated.

33074 **(LA-UR—81-2628) Use of oxide decompositions in advanced thermochemical hydrogen cycles for solar heat sources. Application of the tricobalt tetraoxide-cobalt monoxide pair.** Jones, W.M.; Bowman, M.G. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 9p. (CONF-810942—6). NTIS, PC A02/MF A01. Order Number DE81030235.

From International Energy Agency Annex I workshop on thermochemical hydrogen; Julich, F.R. Germany (23 Sep 1981).

The concept of utilizing oxide decompositions in advanced thermochemical hydrogen cycles for solar heat sources is introduced. It has particular interest in allowing direct transmission of energy to the process through an air window. A cycle for the $Co_3O_4$-CoO pair would be, schematically: (1) $Co_3O_4 = 3CoO + 1/2\ O_2$; (2) $I_2(s,l) + Mg(OH)_2 + 3CoO = MgI_2(aq) + Co_3O_4 + H_2O(l)$; (3) $H_2O + MgI_2(aq) = MgO + 2HI$; (4) $2\ HI = H_2 + I_2$; and (5) $MgO + H_2O = Mg(OH)_2$. Reaction (2) should give a high concentration of $MgI_2$ that would be favorable for (3). The solutions would also contain iodine dissolved as polyiodide, partly offsetting this advantage. Preliminary results indicate that reaction (2) is slow at 150°C. It is surmised that the mechanism of (2) consists of the iodine disproportionation reaction (6), followed by reaction (7). (6) $I_2(s,l) + Mg(OH)_2 = 5/6\ MgI_2(aq) + 1/6\ Mg(IO_3)_2(aq) + H_2O(l)$; (7) $1/6\ Mg\ (IO_3)_2(aq) + 3\ CoO = 1/6\ MgI_2(aq) + Co_3O_4$. Other workers have found (6) to be relatively fast and with a good yield at 150°C. We have found the independently studied reaction (7) to be sufficiently slow at 150°C to account for the slowness of (2). The yield of (7) was found to be proportional to the square root of the time, which suggests that iodate must diffuse through an adherent, accumulating $Co_3O_4$ layer. Since (7) is much fasterwhen $Mg(IO_3)_2$ is replaced by $KIO_3$, the $Mg^{2+}$ ion may catalyze formation of an adherent $Co_3O_4$ spinel layer. The reactivity of CoO in the $KIO_3$ analog of (7) is greatly decreased by exposure to high temperature. Work will be continued to resolve these problems.

33075 **(TAC/H—81-001) Hydrogen energy: a bibliography with abstracts. Quarterly update, January-March 1981.** (New Mexico Univ., Albuquerque (USA). Technology Application Center). May 1981. 104p. Univ. of New Mexico, Albuquerque. Order Number DE81903431.

This update to Hydrogen Energy cites 219 additional influences identified during the fourth quarter of 1980. Production, utilization, materials, transmission, distribution, and storage are covered.

33076 **(UCRL—86622) Solar furnace study of zinc sulfate decomposition.** Krikorian, O.H.; Shell, P.K. (Lawrence Livermore National Lab., CA (USA)). 31 Aug 1981. Contract W-7405-ENG-48. 4p. (CONF-810942—2). NTIS, PC A02/MF A01. Order Number DE81029606.

From International Energy Agency Annex I workshop on thermochemical hydrogen; Julich, F.R. Germany (23 Sep 1981).

The objectives of this study are: to establish the applicability of solar central receivers to thermochemical cycles that can utilize solid sulfate decomposition as the high temperature step; to demonstrate the use of a rotating kiln that has been designed to couple with materials that have low absorbtivities (e.g., solid sulfates); and to study the advantages of the high temperatures and rapid heating rates provided by solar collectors for the decomposition of $ZnSO_4$. Construction of the kiln is currently about half completed. Mullite, $Al_2O_3$, and Inconel-600 will be used as alternative kiln liner materials.

33077 **(UCRL—86623) Use of alkali metal-acid phosphates for elevated temperature water electrolysis.** Shell, P.; Steinbugler, M.; Krikorian, O. (Lawrence Livermore National Lab., CA (USA)). 31 Aug 1981. Contract W-7405-ENG-48. 4p. (CONF-810942—3). NTIS, PC A02/MF A01. Order Number DE81029607.

From International Energy Agency Annex I workshop on thermochemical hydrogen; Julich, F.R. Germany (23 Sep 1981).

The use of molten salts containing water as electrolytes for the high temperature electrolysis of water is being investigated as part of a research program on Thermochemical Cycles for the Production of Hydrogen. The purpose of this study is to determine the behavior of phosphate-based electrolytes during electrolysis. The behavior of these molten salts was observed while measuring the cell potential as a function of time at constant current densities up to 1 $A/cm^2$ using platinum electrodes. The cell resistance was also monitored before and after polarization in order to correlate the electrolyte conductivity to the degree of dehydration. The following characteristics of the electrolyte was observed; tendency to dehydrate in an open container; dehydration effect was most pronounced in the sodium-and lithium-based electrolytes, with the potassium-based electrolytes showing a relatively slow dehydration rate; tendency of the sodium-and lithium-based electrolytes to become viscous and form hard crusts on the electrolyte surface; the potassium electrolyte did not form these viscous melts or surface crusts; lowest cell potentials were obtained for the sodium- and potassium-based electrolytes at 300 and 350°C. On the basis of these results, further work is warranted for the sodium and potassium electrolytes.

33078 **Parametric study of the cadmium thermoelectrochemical hydrogen cycle.** Schreiber, J.D.; Carty, R.H. Chicago, IL; Institute of Gas Technology (1981). 5p.

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

A parametric study of the flowsheet efficiency of the Institute of Gas Technology (IGT) Hybrid Cadmium Cycle, Reactions 1 through 3, has been performed. (1) $Cd(s) + 2H_2O(l) \rightarrow Cd(OH)_2(s) + H_2(g)$ (electrolysis) (2); $Cd(0H)_2(s) \rightarrow Cd0(s) + H_2O(g)$; and (3)$d0(s) \rightarrow Cd(g) + 1/2\ 0_2(g)$. All steps of this cycle have been experimentally investigated. Reaction 1 was conducted electrolytically with a sodium chloride electrolyte to produce cadmium chloride in the anode compartment and hydrogen and sodium hydroxide in the cathode compartment. The cadmium chloride and sodium hydroxide solutions are then removed and mixed to form the $Cd(0H)_2$ precipitate and NaCl solution. The rate of Reaction 2 has been studied at temperatures between 425 and 675 K. The decomposition of the cadmium oxide, Reaction 3, has been demonstrated using concentrated solar heat in a SERI-sponsored program. The parameters varied in this study of the cycle flowsheet efficiencies were - Electrolytic cell voltage: 0 to 1 V; Temperature of Cd0 decomposition: 300 to 1900 K; and Heat loss due to quenching of the cadmium vapor formed in Reaction 3: 0% and 100%. At a cell potential of 0.2 V, the efficiencies were - No quenching of Cd Vapor: 53.7% to 61.1%; and Total quenching: 37.8% to 42.1% over the temperature range investigated.

### 0802 Storage

*REFER ALSO TO CITATION(S) 33075, 33592*

### 0803 Transport

*REFER ALSO TO CITATION(S) 33075*

### 0806 Industrial And Commercial Use

*REFER ALSO TO CITATION(S) 33075*

### 0808 Properties

*REFER ALSO TO CITATION(S) 32830*

## 09 OTHER SYNTHETIC AND NATURAL FUELS

### 0901 Hydrocarbon Fuels

*REFER ALSO TO CITATION(S) 32839, 33494, 33743*

33079 **(ANL/CNSV—22) Advanced system experimental facility: solid waste to methane gas. Background and process description.** Isaacson, R.; Pfeffer, J. (Argonne National Lab., IL (USA)). Mar 1981. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01. Order Number DE81030198.

The Refuse Conversion to Methane Facility in Pompano Beach, Florida, a 100-ton/day experimental plant to convert municipal solid waste (MSW) to methane for fuel, has been built and is being tested. The facility has been designed to assess the technical merit of anaerobic digestion of the MSW process. Approximately 40 ton/day of volatile solids are fed to the digesters; of this, about 25 ton/day will be converted to gases. For each pound of volatile solids destroyed, 6.6 std. $ft^3$ of methane gas and 6.6 std. $ft^3$ of $CO_2$ will be produced. Thus, the plant will yield approximately 330,000 std. $ft^3$/day each of methane and $CO_2$. This project provides a critical test of the most important process variables, thus allowing judgments to be made on scale-up considerations. The successful operation of this facility will yield information with a significant impact on potential commercial-scale plant developments. The background and theory involved in applying this technology to MSW, as well as details of the specific process line, are presented.

**33080 (DOE/ER/10345—2) Mechanistic studies of carbon monoxide reduction. Progress report, August 1, 1980-August 1, 1981.** Geoffroy, G.L. (Pennsylvania State Univ., University Park (USA)). 20 Jul 1981. Contract AS02-79ER10345. 42p. NTIS, PC A03/MF A01. Order Number DE81030063.

The long-range objective of this research program is to contribute to the understanding of the mechanisms by which carbon monoxide is reduced by hydrogen on the surface of metal particles and in homogeneous solutions. There is a need for good mechanistic studies directed toward developing an understanding of the mechanisms of the various synthesis gas reactions which would aid in the development of better catalysts. In this proposed research, such mechanistic studies are conducted from two approaches: the mechanism of the heterogeneous, metal particle catalyzed reduction of carbon monoxide will be investigated by using transition metal cluster complexes to model the metal surfaces; the mechanism of synthesis gas chemistry will be carried out in homogeneous solution, focusing on a few key mechanistic steps, and some exploratory work is proposed concerning the methanol homologation reaction. Progress reports are presented for the following areas of investigation: stepwise reduction of CO to $CH_4$ on a triosmium cluster face; conversion of $Os_3(CO)_{11}(\mu\text{-}CH_2)$ into $H_2Os_3(CO)g(CCO)$ - a model for chain growth on metal surface; structures of tetranuclear Fe-Ru clusters as models for CO activation; reactions directed toward the preparation of acyl- and alkyl-substituted clusters; and fragmentation of tetranuclear mixed-metal clusters by reaction with CO. (AT)

**33081 (DOE/ET/14696—T6) Peat biogasification development program.** (Minnesota Gas Co., Minneapolis (USA)). 21 Apr 1981. Contract AC01-79ET14696. 240p. NTIS, PC A11/MF A01. Order Number DE81028299.

The advantage of the biogasification method is it can use the peat in a high moisture state, thereby eliminating the need to provide energy for drying peat. A preliminary investigation (Appendix B) of the peat biogasification process (funded by Minnesota Gas Company) showed potential technical and economic feasibility of the process, sufficient to carry out the present program. Based on the results of the present program the solubilization, oxidation, and digestion steps have been defined sufficiently to lead to a more reliable process design and preliminary estimate of the fuel gas production costs. This present program was initiated to develop an experimental data base for the solubilization, oxidation, and fermentation reactions, and to use this data base to develop a conceptual preliminary process design and thus enable a preliminary estimation of the economics (capital and operating costs and unit gas costs) for the process. The phases of this peat biogasification program included an experimental study followed by a preliminary conceptual design, the results of which are summarized below.

**33082 (DOE/FE/20219—2) Feasibility and economic study of medium-Btu coal gas blended with high-Btu by-product gas as an industrial energy source at Billings, Montana. Final report.** (Boeing Co., Seattle, WA (USA). Boeing Engineering and Construction Div.; Northern Resources, Inc., Billings, MT (USA)). May 1981. Contract FG01-79RA20219. 297p. NTIS, PC A13/MF A01. Order Number DE81030622.

This study assesses the technical and economic feasibility of blending a medium-Btu gas (MBG) produced from coal by the Winkler fluidized bed gasification process with excess refinery fuel gas to be used as an industrial fuel in Billings, Montana. This report includes a discussion of the background of the project; the site selection process; the conceptual design of the process and supporting facilities; the retrofit requirements and other costs associated with burning the MBG; the environmental and permitting aspects of the project; the cost estimates and economic considerations; the contract provisions for MBG buy/sell agreements; the government's role in supporting the project; and the market potential for the project in Billings and similar projects in other markets. The study concludes that the project is technically feasible and economically viable today although parity with conventional fuels will not occur until 1985.

**33083 (DOE/PC/30304—2) Soot formation in synfuels. Second quarterly report, 1 January 1981-31 March 1981.** Olson, D.B. (Aerochem Research Labs., Inc., Princeton, NJ (USA)). Aug 1981. Contract AC22-80PC30304. 21p. NTIS, PC A02/MF A01. Order Number DE81030273.

An experimental program is underway to study the effects of molecular structure, pressure, and temperature on soot production in laboratory flames of selected synfuel component hydrocarbons. The objective of Task I is to measure the Threshold Sooting Index, flame temperature, and soot concentration for some 50 fuels in premixed and diffusion flames. During this reporting period a new liquid metered fuel vaporizer was built and tested to replace a boiler-type fuel system that failed to perform adequately. The three wavelength optical probe for measuring emission temperatures and soot concentrations was built and calibrated against a tungsten lamp. Sampling probes for the mass spectrometer being used in Task II for flame structure analysis were tested this period. The 90° stainless steel sampling probes failed due to overheating to 120° probes were built (with thicker walls and a higher temperature steel alloy). A new electrostatic lens system to focus the flame ions into the mass filter was also built and installed in the apparatus.

**33084 Hybrid biothermal conversion of biomass to methane.** Srivastava, V.J.; Novil, M.; Tarman, P.B.; Chynoweth, D.P. Chicago, IL; Institute of Gas Technology (1981). 32p. (CONF-810380—2). Inst. of Gas Technology, 3424 South State St., Chicago, IL 60616.

From Biogas and alcohol fuels seminar; Chicago, IL, USA (12 Mar 1981).

Gasification of biomass to SNG and medium BTU gas by either bioconversion or thermochemical processes is discussed. A preliminary evaluation of IGT's BIOTHERMGAS process has shown that combining biochemical and thermochemical gasification results in an economic process with a higher conversion efficiency and a greater choice of feedstocks that can be processed than either biological or thermochemical processes used separately. The biogasification component can receive high moisture feeds, can convert major portions of feed at low temperature and pressure, and can be used for methanation of synthesis gas. The thermochemical gasifier converts refractory organic residues from the anaerobic digesters and provides gases that can be used for heating, mixing, and stimulating methanogenesis in the biological component. Research planned for further demonstration of the technical and economic feasibility of the process will include further evaluation of the process at the laboratory scale, a more detailed systems and economic study, and process design and scale-up.

**33085 Bioconversion energy systems: new developments and opportunities.** Ghosh, S. Chicago, IL; Institute of Gas Technology (1981). 22p. (CONF-810730—3). Inst. of Gas Tech., 3424 South State St., Chicago, IL 60616.

From 1981 national conference on environmental engineering; Atlanta, GA, USA (8 Jul 1981).

A discussion on bioconversion applications in beneficiation, direct conversion, and biotreatment is presented. Bioconversion constitutes an important element in meeting the nation's near-term energy goals. Anaerobic digestion is preferred over other biological processes because it produces a clean fuel, it has commercial applications, it produces an energy product and by-product, pretreatment is not necessary, product gases are easily separated, and it has a higher net energy production efficiency than fermentation. Advanced anaerobic digestion systems are described. (DMC)

33086 **Kinetics of acid-phase fermentation in anaerobic digestion.** Ghosh, S. Chicago, IL; Institute of Gas Technology (1981). 23p. (CONF-810554—3). Inst. of Gas Tech., 3424 South State St., Chicago, IL 60616.

From 3. symposium on biotechnology in energy production and conservation; Gatlinburg, TN, USA (12 May 1981).

Acid-phase fermentation of organic feeds is important not only because it is a key step in anaerobic digestion, but also because it can generate a variety of acids that are used as industrial intermediates or can serve as feeds for hydrocarbon production. In this research, dominant cultures of acid-formers containing acidogenic and acetogenic organisms were established on glucose and sewage sludge by appropriate manipulation of the digester HRT and organic loading. Kinetic models were developed to describe the product formation rate and efficiency and to determine process kinetic constants by analysis of the collected digestion data.

## 0902 Alcohol Fuels

*REFER ALSO TO CITATION(S) 32848, 33080, 33494, 33872*

33087 **Distribution of ethanol-water mixtures to organic liquids.** Roddy, J.W. (Oak Ridge Natl Lab, Tenn). *Industrial and Engineering Chemistry Process Design and Development ;* **20**: No. 1, 104-108(Jan 1981).

Distribution measurements for ethanol (D/sub EtOH/) and water (D/sub HOH/) from ethanol-water mixtures to several undiluted organic liquids were measured at 20, 25, and 40/degree/C from 0.1 and 1.0 M ethanol by a tracer counting technique. For the classes of compounds studied, the order of extractability of ethanol was hydrocarbon?halocarbon<ether<ketone<amine<ester<alcohol?phosphate. The highest D/sub EtOH/ obtained was 0.69 with 2-ethyl-1-butanol, while triisobutyl phosphate gave a slightly lower value of 0.65. Separation factors, D/sub EtOH//D/sub HOH/, are calculated for each liquid. 19 refs.

## 0904 Solid Waste And Wood Fuels

33088 **(EPRI-CS—1983-Vol.1) Cofiring of refuse-derived fuel and coal at Oak Creek. Volume 1. Boiler corrosion evaluation. Final report.** Plumley, A.L.; Roczniak, W.R. (Combustion Engineering, Inc., Windsor, CT (USA)). Aug 1981. 247p. NTIS, PC A11/MF A01. Order Number DE81904238.

A 4000-hour controlled-temperature probe evaluation was conducted to determine the long term impact of co-firing coal and refuse derived fuel (RDF) on corrosion of boiler materials in Oak Creek Unit 7 of Wisconsin Electric Power Company (WEPCO). The evaluation was jointly sponsored by the Electric Power Research Institute (EPRI) and WEPCO. Two horizontal superheater probes are divided into two sections: a water-cooled supporting shank and the air-cooled sample section which consists of cylindrical 2 in. diameter specimens threaded together to form the test superheater element. The test probe metal temperature is regulated and monitored by means of thermocouples embedded in the specimen walls. The two waterwall probes each consist of five similar cylindrical test specimens mounted vertically in the plane of the furnace wall. The low-temperature probes have split ring specimens mounted around a central fluid-filled core, the temperature of which is maintained by means of an immersed cooling coil. Evaluations included weight loss, penetration, and metallurgical examination as well as chemical examination of selected deposits. While wastage increased with increasing metal temperatures, no significant wastage was attributable to the 10 to 15% replacement of coal by RDF. Future plans include slag and deposit analysis and exposure of additional probes.

# 13 HYDRO ENERGY

33089 **(EGG-M—02781) Micro-hydropower in the United States.** Haroldsen, R.O.; Simpson, F.B. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 9p. (CONF-8106137—5). NTIS, PC A02/MF A01. Order Number DE81028271.

From WATERPOWER 1981 conference; Washington, DC, USA (22 Jun 1981).

An assessment study of the interest and problems relating to the development of micro-hydropower, i.e., capacities of less than 100 kW, was completed in December 1980 under DOE sponsorship. A total of 62 individuals from 10 states and 4 groups, i.e., developers, A/E firms, equipment manufacturers, and state and federal agencies, were polled to determine their perceptions of the advantages and disadvantages of micro-hydro developments and the needs for such developments. Financing, technical assistance, and help with the economic analysis and regulatory aspects of micro-hydro development appeared to be the paramount needs. Whether or not a specific site can be successfully developed depends on site conditions. A micro-hydro plant discussed as an example is shown to be a poor investment, e.g., maximum $200 per month return on $60,000 investment.

## 1303 Plant Design And Operation

*REFER ALSO TO CITATION(S) 33371*

# 14 SOLAR ENERGY

*REFER ALSO TO CITATION(S) 33399*

33090 **(NP—1903916) Status of solar energy research and development in Australia.** Saunders, S. (Solar Energy Research Inst., Western Australia (Australia)). May 1981. 28p. NTIS, PC A03/MF A01.

The paper briefly describes the solar energy research and development program in Australia. Programs showing promise of widespread application being researched are: solar industrial process heat, solar air conditioning, solar electricity production, and biomass fuels. Solar applications not covered but being actively researched in Australia include: electricity production using solar ponds; passive and active heating and cooling of buildings; domestic and swimming pool solar water heating; production of methanol from biomass; the use of vegetable oils to substitute for diesel fuels, methane production from urban, food processing and animal waste; and extraction of hydrocarbon fuels from plants.

33091 **(SERI/TP—351-508) Prospects for investment in solar energy.** Edesess, M. (Solar Energy Research Inst., Golden, CO (USA)). Dec 1979. Contract AC02-77CH00178. 15p. NTIS, PC A02/MF A01. Order Number DE81028006.

The prospects for solar energy and the growth of the solar industry are discussed. Some misconceptions, capital requirements, energy payback, and growth rate are reviewed. Technologies briefly discussed in the order in which they will likely be commercialized are: conservation, passive solar, biomass, flat plate collectors for water and space heating, wind power, solar ponds, photovoltaics, concentrating collectors for high temperature heat and electricity generation, ocean thermal energy conversion systems, and the solar power satellite. (MCW)

33092 **(SOLAR/0020—81/44) Availability of solar energy reports from the National Solar Data Program.** (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). Jul 1981. Contract AC01-79CS30027. 66p. NTIS, PC A04/MF A01. Order Number DE81026211.

This booklet discusses the various types of reports published by the National Solar Data Program, lists the reports issued prior to July 15, 1981, and provides order blanks for obtaining copies of reports. The reports identified in the following pages are segmented into nine types: monthly performance reports; solar energy performance evaluation reports; solar performance bulletins;environmental data reports;solar project description reports;solar project cost reports;program information reports;comparative reports; and reliability and material assessment reports. For convenience, available site-specific reports are listed alphabetically by site name, solar system type, and by state. These reports are disseminated through the US Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830.

33093 **(TAC-STPG—81-001) Solar power generation: a bibliography with abstracts. Quarterly update, January-March 1981.** Sparkman, T.; Bozman, W.R. (eds.). (New Mexico Univ., Albuquerque (USA). Technology Application Center). Jun 1981. 168p. Univ. of New Mexico, Albuquerque. Order Number DE81903759.

This annotated bibliography covers: energy overviews; solar overviews; energy conservation; environment, health, and safety; economics, law, and policy; total energy, hybrid, and combined systems; solar thermal power; thermoelectric, thermionic, and thermochemical; ocean thermal energy conversion; wind energy; biomass, bioconversion, biochemical and energy storage. An author index and a keyword index are included. (LEW)

## 1401 Resources And Availability

*REFER ALSO TO CITATION(S) 33150, 33386*

33094 **(MIT-EL—79-032-Vol.1) Solar energy conversion systems engineering and economic analysis. Volume I.** Russo, G. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Nov 1979. Contract AC02-76ET20279. 216p. NTIS, PC A10/MF A01. Order Number DE81029645.

The energy balance of the sun-earth system is derived by applying the Stefan-Boltzmann, Kirchoff, and Lambert laws of irradiance. In the ideal case of a pure sun-earth Newtonian system, given the earth's orbital parameters, expressions are derived for the declination angle, azimuth and altitude of the sun, period of daytime, and the zenith angle. The absorption of solar radiation by atmospheric water, ozone, oxygen and minor constituents, and radiation scattering are analyzed. A physical model is derived to describe the solar energy radiative flux depletion in its atmospheric path, and the concepts and techniques needed to compute those coefficients of the model that are dependent on meteorological conditions are developed. (LEW)

33095 **(MIT-EL—79-033-Vol.2) Solar energy conversion systems engineering and economics analysis. Input definition. Volume II.** Russo, G. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Nov 1979. Contract AC02-76ET20279. 151p. NTIS, PC A08/MF A01. Order Number DE81029646.

The CIRR2 program for the computation of the global energy flux is described. The code's general criteria of implementation are discussed: (1) economy of the model; (2) minimization of memory locations employed; (3) versatility of the input and output interfaces. Block diagrams are given of the code and of the individual subroutines. An analysis is performed for the months of February and June 1979, Albany, NY, and the results are analyzed against the corresponding measured data. (LEW)

33096 **(SERI/TP—642-1343) Terrestrial solar spectral modeling.** Bird, R.E. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1981. Contract AC02-77CH00178. 12p. (CONF-810748—1). NTIS, PC A02/MF A01. Order Number DE81029067.

From Commercial photovoltaics measurements workshop; Vail, CO, USA (27 Jul 1981).

Two rigorous radiative transfer codes called SOLTRAN and BRITE are described. SOLTRAN was constructed from an atmospheric transmission code which uses a layered atmosphere model between sea level and 100-km altitude. This code includes no scattered radiation in its output. The BRITE code uses a Monte Carlo method and a layered atmosphere model, and accounts for both scattering and absorption. Spectra produced using the BRITE code are illustrated, and the use of SOLTRAN and BRITE for photovoltaic applications is demonstrated. Spectral comparisons between SOLTRAN, BRITE, and a spherical harmonics code are presented. Recommendations are made for improving the codes. (LEW)

## 1403 Economics

*REFER ALSO TO CITATION(S) 33128, 33130, 33131, 33132*

33097 **(MIT-EL—80-028) Cost goals for a residential photovoltaic/thermal liquid collector system set in three northern locations.** Dinwoodie, T.L.; Kavanaugh, J.P. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Oct 1980. Contract AC02-76ET20279. 61p. NTIS, PC A04/MF A01. Order Number DE81029700.

The allowable costs for a residential PV/T liquid collector system are compared with those of both PV-only and side-by-side PV and thermal collector systems. Four types of conventional energy systems provide backup: all oil, all gas, all electric resistance, and electric resistance hot water with space heating by parallel heat pump. Electric space cooling is modeled, and the electric utility serves as backup for all electrical needs. The analysis is separated into two parts. The first is a base case study using conservative market and financial parameters for comparing PV/T economics in three northern locations: Boston, Madison, and Omaha. All parameter estimates are for a privately purchased residence, newly constructed in 1986. Three measures are used for establishing allowable costs, including system breakeven capital cost, allowable levalized annual costs, and an allowable combined collector cost when compared directly with a side-by-side collector system. In the second portion the sensitivity of PV/T economics to pertinent physical, market, and financial variables is examined. The difference in economic outlook for PV/T in retrofit applications is also estimated. The results indicate that, for those northern locations modeled, the allowable cost for a combined collector system is roughly \$10-\$30/$m^2$ less than that of separate (side-by-side) collector systems, at total array areas between 40-80 $m^2$. Below this range, allowable costs diverge, benefiting optimally sized separate collector systems. All systems look best when operating against all-electric homes. Retrofit applications appear favorable over newly designd homes, although here there is need to assess alternative retrofit options such as conservation.

33098 **(MIT-EL—81-012) Photovoltaic market analysis program: background, model development, applications and extensions.** Lilien, G.L.; Fuller, F.H. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Apr 1981. Contract AM01-76EI02295. 158p. NTIS, PC A08/MF A01. Order Number DE81029711.

The market analysis program for photovoltaics is described and motivated. The main objective of the program is to develop tools and procedures to help guide government spending decisions associated with stimulating photovoltaic market penetration. The program has three main components: (1) theoretical analysis aimed at understanding qualitatively what general types of policies are likely to be most cost effective in stimulating PV market penetration; (2) operational model development (PV1), providing a user oriented tool to study quantitatively the relative effectiveness of specific government spending options and (3) field measurements, aimed at providing objective estimates of the parameters used in the diffusion model used in PV1. Much of this report is structured around the development and use of PV1, an interactive computer model designed to determine allocation strategies for (constrained) government spending that will best accelerate private sector adoption of PV. Existing models of solar technology diffusion are reviewed, and it is shown that they a) have not used sound diffusion principles and b) are not empirically based. The structure of the PV1 model is described and shown to address these problems. Theoretical results on optimal strategies for spending federal market development and subsidy funds are then reviewed. The validity of these results is checked by comparing them with PV1 projections of penetration and cost forecasts for fifteen government policy strategies which were simulated on the PV1 model. Extensions of the model and approach to other technologies are discussed.

## 1404 Environmental, Legal, And Institutional Aspects

*REFER ALSO TO CITATION(S) 33127, 33152, 33153, 33154, 33434, 33761*

33099 **(MIT-EL—79-029) Research design for institutional analysis of HUD's solar heating and cooling demonstration program.** Nutt-Powell, T.E. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). May 1979. Contract AC02-76ET20279. 68p. NTIS, PC A04/MF A01. Order Number DE81029697.

Each institutional entity in the housing arena is defined briefly according to the functions it fulfills and the activities it performs in meeting those functions. These definitions are used to develop a series of interaction matrices, representing the exchanges characteristic of institutional entities by function, and indicating the relative intensity of the interaction. The HUD program is described and its role as the perturbation prompter for institutional analysis is examined. The specific method for the analysis is described. (LEW)

33100 **(MIT-EL—79-030) Solar heating and cooling of housing: five institutional analysis case studies.** Nutt-Powell, T.E.; Furlong, M.; McDaniel, P.; Parker, B.; Reamer, A. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jun 1979. Contract AC02-76ET20279. 120p. NTIS, PC A06/MF A01. Order Number DE81029651.

The case studies reported here involve use of solar thermal technologies in various residential settings. Each of the five cases illustrates one or more institutional forces which influence the acceptance of solar energy in the residential sector. Friends Community is an instance of developer involvement for reasons other than profit, and the way in which other factors (such as designers and consumers) react to such housing development. Reservoir Hills Solar Houses illustrates the process of entry by new development firms, the role of public agencies in encouraging various forms of housing and the problems of using product innovations without adequately developed industry support infrastructures. Project Solar for Indiana illustrates the importance of supporting institutional networks, in this case the homebuilders association, the state government and key individuals, who play mediating and legitimating roles in solar acceptance. Solar in California discusses public efforts at a city level - Santa Clara, a county level - San Diego, and the state level in what is generally regarded as the state most active in turning to forms of solar energy. Finally, PNM/AMREP illustrates the process of large development corporation decision making, and the manner in which an investor-owned utility is shifting its orientation of energy provision.

33101 **(MIT-EL—79-044) Institutional analysis of solar heating and cooling of housing: summary report.** Nutt-Powell, T.E. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Sep 1979. Contract AC02-76ET20279. 35p. NTIS, PC A03/MF A01. Order Number DE81029644.

The study of solar thermal applications in housing provides useful guidance in structuring programs for PV acceptance in the residential sector. The five cases illustrate one or more institutional forces which influence the acceptance of solar energy in housing. The cases involve residential developments of various sorts, located in Massachusetts, Maryland, Indiana, New Mexico and California. It is determined that each actor in the residential sector has different, and complex motivations for considering, using and continuing to use an innovation such as solar energy. The choices of any given actor are a function of the type, source, density and continuity of information exchanges found within the institutional arena in which he/she operates. Finally, the probability of rate and extent of innovation acceptance will be increased to the degree that the innovation is made comprehensible.

33102 **(MIT-EL—80-007) Photovoltaics and the national park service: an institutional analysis.** Nutt-Powell, T.E.; Sorrell, L.; Siczewicz, P. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Apr 1980. Contract AC02-76ET20279. 37p. NTIS, PC A03/MF A01. Order Number DE81029695.

This study involves the acceptance of photovoltaics (PV) by the National Park Service. As part of the Department of the Interior, the NPS is an agency exemplifying the federal non-defense sector. A modified organizational set model which concentrates on exchanges between and among organizational set elements, was used in this study. Though initially the inquiry from the Department of Energy to NPS to do a PV field test at a NPS site was considered the perturbation prompter, preliminary exploration showed an earlier perturbation - the need for energy conservation. The differentiations which followed on this perturbation provided an envelope within which PV was subsequently considered and accepted. This envelope made an otherwise incomprehensible innovation more comprehensible by its association with an ongoing routine of acceptance of energy conservation initiatives. The critical role of the NPS's Denver Service Center as an innovation mediator is described. The DSC serves such a function routinely for the NPS, a reality which greatly enhances the likelihood of acceptance of innovations disseminated through this institutional entity.

33103 **Solar access and land use planning: a bibliography.** Vidich, C. Chicago, IL; CPL Bibliographies (1981). 12p. (NP—1903712). $4.00.

The bibliography includes summaries of legal perspectives on protecting solar access through traditions land use control of zoning and subdivision regulations, easements, covenants, and nuisance laws. A separate listing of the most significant solar access regulations adopted in the United States is presented. (MHR)

33104 **Solar energy for California's residential sector: progress, problems, and prospects.** Hollon, J.K. Berkeley, CA; University of California (1980). 81p. (NP—1903616).

Problems and prospects for meeting the objective of widespread residential implementation of solar resources in California are addressed. The problems addressed are classified as institutional, and attention here is directed to actions taken by California and not the Federal government. This paper includes a synopsis of California's current solar policies, goals, legislation, organizations, and projects, along with interviewees' impressions of current activities and barriers to implementation. Respondents provided a list of broadly supported recommendations for stimulating residential use of solar energy in California. Principal barriers identified are needed for consumer education, lack of reliability of system installations, and problems of financing. Other barriers discussed include professional inertia of design and building industries, local building codes and ordinances, lack of criteria for system performance, artifically low utility rates, inefficiencies of government, and problems of the economy. Findings are analyzed and conclusions are presented.

## 1405 Solar Energy Conversion

*REFER ALSO TO CITATION(S) 33074, 33076, 33084, 33085, 33086, 33097, 33134*

33105 **(A—093692) Luminescent photoelectrochemical cells. 5: multiple emission from tellurium-doped cadmium sulfide photoelectrodes and implications regarding excited state communication.** Karas, B.R.; Streckert, H.H.; Schreiner, R.; Ellis, A.B. (Wisconsin Univ., Madison (USA)). Dec 1980. 26p. NTIS PC A03/MF A01.

Samples of single crystal, n-type, 100 ppM Te-doped CdS (CdS:Te) exhibit two emission bands when excited at several ultraband wavelengths. When CdS:Te was used as the photoanode in a photoelectrochemical cell employing sulfide electrolyte, both emission bands were quenched in parallel during passage of photocurrent resulting from 457.9 or 476.5 nm Ar ion laser excitation. The existence of excited state communication is inferred from the effects of temperature and electrode potential on multiple emission.

33106 **(DOE/ET/20077—T1) Assessment of wood-chipping machinery for harvesting non-commercial timber in New England.** Crossley, F.R.E. (Massachusetts Univ., Amherst (USA)). Feb 1981. Contract FG01-78ET20077. 139p. NTIS, PC A07/MF A01.

The variety of wood chippers that exist which can be used for whole-tree chipping is examined. The classes of wood chippers are contrasted. Brief data on the economies and forest productivi-

ties of Massachusetts and Finland are compared. Details on five distinct chipping systems and costs of producing chips by the various systems are given. Debilitating the forest fertility as a result of whole-tree chipping is discussed. The consumer market for wood chips in the Northeastern US is reviewed. (MCW)

33107 **(DOE/ET/23047—T2) Thin-film polycrystalline-silicon solar cells. Quarterly report No. 1, January 1-March 31, 1979.** Ghosh, A.K.; Feng, T.; Maruska, H.P.; Fishman, C. (Exxon Research and Engineering Co., Linden, NJ (USA)). 1979. Contract AC03-79ET23047. 52p. NTIS, PC A04/MF A01. Order Number DE81026765.

A theory capable of predicting the performance of polycrystalline silicon solar cells is formulated. It relates grain size to mobility, lifetime, diffusion length, reverse saturation current, open circuit photovoltage and fill factor. Only the diffusion lengths measured by the surface photovoltage technique for grains $\leqq 5$ μm do not agree with our theory. The reason for this discrepancy is presently being investigated. It is concluded that grains $\geqq 100$ μm are necessary to achieve efficiencies $\geqq 10\%$ at AM1 irradiance. The calculations were performed for the case of no grain boundary passivation. The parameters that best fit the available data are found to be: (1) number of surface states at grain boundaries acting as recombination centers = $1.6 \times 10^{13}/cm^2$; (2) capture cross section = $2 \times 10^{-16}$ $cm^2$; (3) surface recombination velocity at grain boundary = $3.2 \times 10^4$ cm/sec. The following types of solar cells are considered in the model: $SnO_2$/Si Heterostructure, MIS, and p/n junction. In all types of solar cells considered, grain boundary recombination plays a dominant role, especially for small grains. Though the calculations were originally expected to yield only order of magnitude results, they have proven to be accurate for most parameters within 10%.

33108 **(DOE/JPL—1012-78/11) Bias-humidity testing of solar-cell modules.** Hoffman, A.R.; Miller, E.L. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Oct 1978. Contract NAS-7-100-5101. 42p. NTIS, PC A03/MF A01. Order Number DE81029361.

The feasibility of implementing bias-humidity development testing to determine if field-like failure modes would result is demonstrated. Variables resulting in degradation were separated so causative variables could be identified. The studies were done on silicon solar cell modules from different manufacturers. Following each of the ten-day bias-humidity tests, the modules were examined, photographed, and tested. Limited bias-related changes were observed. (LEW)

33109 **(DOE/JPL/954334—19) Low-cost solar-array project: experimental process system development unit for producing semiconductor-grade silicon using the silane-to-silicon process. Quarterly progress report, April-June 1981.** (Union Carbide Corp., Sistersville, WV (USA)). 1981. Contract NAS-7-100-954334. 44p. NTIS, PC A03/MF A01. Order Number DE81028196.

This phase consists of the engineering design, fabrication, assembly, operation, economic analysis, and process support R and D for an Experimental Process System Development Unit (EPSDU). The mechanical bid package was issued and the bid package was issued and the bid responses are under evaluation. Similarly, the electrical bid package was issued, however, responses are not due until the third quarter. The majority of all equipment is on order or has been received at the EPSDU site. The pyrolysis/consolidation process design package was issued. Preparation of process and instrumentation diagram for the free-space reactor has been started. In the area of melting/consolidation, Kayex have successfully melted chunk silicon and have produced silicon shot. The free-space reactor powder was successfully transported pneumatically from a storage bin to the auger feeder twenty-five feet up and was melted. The fluid-bed PDU has successfully operated at silane feed concentrations up to 21%. The writing of the operating manual has started. Overall, the design phase is nearing completion.

33110 **(DOE/JPL/954355—81-18) Large area silicon sheet by EFG. Second quarterly report, April 1, 1981-June 30, 1981.** (Mobil Tyco Solar Energy Corp., Waltham, MA (USA)). 11 Sep 1981. Contract NAS-7-100-954355. 50p. NTIS, PC A04/MF A01. Order Number DE81029907.

The influence of parameters such as $CO_2$ concentration, gas flow patterns, quartz in the bulk melt, melt doping level and growth speed on ribbon properties has been examined for 10 cm wide ribbon. One of the more important findings is that ribbon quality is optimized for ambient $CO_2$ in argon concentrations in the range from 1000 to 5000 ppM. Cell performance degrades at $CO_2$ concentrations above 500 ppM and IR interstitial oxygen levels decrease. Cartridge parameters influencing the ribbon thickness have been studied and thickness uniformity at 200 micrometers has been improved. Growth stability at the target speed of 4.0 cm/minute has also been improved significantly. A successful demonstration of interface ambient control has been carried out. Ribbon characterization has shown that SPV diffusion lengths and cell performance have improved with $CO_2$ introduced into the multiple furnace environment. The construction of a new multiple ribbon furnace for growth of four 10 cm wide ribbons is proceeding. A new 10 cm cartridge design has been completed, primarily to incorporate modifications in the post-growth temperature profile, and fabrication of components has been started.

33111 **(DOE/JPL/955089—81/11) Silicon solar cell process development, fabrication, and analysis. Ninth quarterly report, 1 January 1981-31 March 1981.** Yoo, H.I.; Iles, P.A.; Leung, D.C. (Optical Coating Lab., Inc., City of Industry, CA (USA). Photoelectronics Div.). 1981. Contract NAS-7-100-955089. 89p. NTIS, PC A05/MF A01. Order Number DE81029905.

Extensive evaluation of two large cast ingots by HEM (Crystal Systems) was carried out. Solar cell performance versus substrate position within the ingots was obtained and the results are presented in detail. Dendritic web samples were analyzed at MRI, in terms of structural defects, and efforts were made to correlate the data with the performance of solar cells made from the webs.

33112 **(DOE/JPL/955733—T1) Development of advanced Czochralski growth process to produce low-cost 150-kG silicon ingots from a single crucible for technology readiness. Second quarterly progress report, January 1-March 31, 1981.** (Kayex Corp., Rochester, NY (USA)). 1981. Contract NAS-7-100-955733. 16p. NTIS, PC A02/MF A01. Order Number DE81028929.

The modified CG2000 crystal grower construction, installation, and machine check-out was completed. The process development check-out proceeded, with several dry runs and one growth run. Several machine calibrations and functional problems were discovered and corrected. Several exhaust gas analysis system alternatives were evaluated and an integrated system approved and ordered. A contract presentation was made at the Project Integration Meeting at JPL, including cost-projections using contract projected throughput and machine parameters. Several growth runs on a development CG2000 RC grower have shown that complete neck, crown, and body automated growth can be achieved with only one operator input. Work continued for melt level, melt temperature, and diameter sensor development.

33113 **(DOE/JPL/955902—81/2) Module experimental process system development unit (MEPSDU). Quarterly report No. 2, March 1, 1981-May 31, 1981.** (Solarex Corp., Rockville, MD (USA)). 1981. Contract NAS-7-100-955902. 51p. NTIS, PC A04/MF A01. Order Number DE81024349.

The baseline process sequence for producing flat-plate photovoltaic modules which meet the price goal in 1986 of 70 cents or less per Watt peak is described. Some proposed changes in this baseline are described, and the detailed module design is given. The results of experiments on various aspects of cell fabrication, including junction formation, antireflection coating, electric contacts, and encapsulation are reported. (LEW)

33114 **(MASEC/R—81-005) Wood resources and utilization patterns in the North Central Region and energy needs for the manufacture of wood products.** Sinclair, S.A. (Mid-American Solar Energy Complex, Minneapolis, MN (USA)). Mar 1981. Contract AC02-79CS30150. 37p. NTIS, PC A03/MF A01. Order Number DE81030356.

The timber resources of the North Central Region are discussed on a state-by-state basis. The discussion of standing timber

growth and removal is in terms of commercial growing stock; however, the total forest biomass may be estimated by simply adding the potential logging residue to the growing stock figure. The energy needs of various wood and paper products plants, Standard Industrial Classification (SIC) Codes 24 and 26, are highlighted. In addition, the ability of various wood manufacturing facilities to generate their energy needs from wood residues and by-products is explored.

33115 **(PNL-SA—9246) Thermochemical production of liquids from biomass.** Elliott, D.C. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 8p. (CONF-810865—1). NTIS, PC A02/MF A01. Order Number DE81030085.

From Solar world forum; Brighton, UK (23 Aug 1981).

The chemistry of this process is essentially that of the CO-Steam process wherein carbon monoxide and water, catalyzed by sodium carbonate, are the reducing agents for the biomass. A water slurry process involving a prehydrolysis step for wood chips has been used to produce the first biomass-derived oil on a large scale. A second variation which requires recycle of a portion of the product for use as the carrier vehicle for wood flour has also been developed to the point of producing multi-barrel quantities of product. An extensive amount of product analysis has been completed on both types of product. They are similar, being highly phenolic and approximately 10% by weight of oxygen. Utilization of the product as a boiler fuel has been tested and other uses of the product are now being investigated. Analytical results and product application tests are discussed.

33116 **(PNL-SA—9751) Spectral response measurements for solar cells.** Hartman, J.S.; Lind, M.A. (Pacific Northwest Lab., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 20p. (CONF-810748—2). NTIS, PC A02/MF A01. Order Number DE81030097.

From Commercial photovoltaics measurements workshop; Vail, CO, USA (27 Jul 1981).

An overview of spectral response measurements, measurement systems, and potential measurement problems are described relative to the characterization of solar cells. Measurement systems are outlined for determining the spectral response, external quantum efficiency, and internal quantum efficiency of solar cells. Practical system components and measurement systems are presented along with their potential advantages and weaknesses. Finally, several solar cell properties (linearity, spatial uniformity, etc.) are discussed which must be considered before a measurement system can be designed to evaluate a specific type of solar cell.

33117 **(SERI/PR—0-9010-2) Amorphous boron-silicon-hydrogen alloys for thin-film heterojunction solar cells. Quarterly technical progress report No. 2, 1 September 1980-30 November 1980.** Moore, A.R.; Carlson, D.E.; Smith, R.W. (Solar Energy Research Inst., Golden, CO (USA); RCA Labs., Princeton, NJ (USA)). May 1981. Contract AC02-77CH00178. 18p. NTIS, PC A02/MF A01. Order Number DE81027234.

The conductivity of a-B:Si:H films increases with substrate temperature and annealing temperature for temperatures up to 500°C (highest investigated). However, increasing the conductivity causes the optical gap to decrease. Preliminary results on a-B:Si:H/a-Si:H heterojunction devices are not encouraging as interface states appear to limit the conversion efficiency to ~ 1.5%.

33118 **(SERI/PR—0-9010-3) Amorphous boron-silicon-hydrogen alloys for thin-film heterojunction solar cells. Quarterly technical progress report No. 3, 1 December 1980-28 February 1981.** Moore, A.R.; Carlson, D.E.; Smith, R.W. (Solar Energy Research Inst., Golden, CO (USA); RCA Labs., Princeton, NJ (USA)). Jun 1981. Contract AC02-77CH00178. 18p. NTIS, PC A02/MF A01. Order Number DE81027254.

Amorphous boron-silicon-hydrogen (a-B:Si:H) alloys have been used to make heterojunction contacts to hydrogenated amorphous silicon (a-Si:H) films. The best conversion efficiency for these heterojunction devices is ~ 1.65% as compared to ~ 5.5% for a-Si:H p-i-n devices made in the same system with similar deposition conditions. The performance of a-B:Si:H/a-Si:H heterojunction cells appears to be limited mainly by a large density of interface states. Investigation is reported of another p-type, wide band-gap material, namely, microcrystalline silicon-carbon-hydrogen (m-Si:C:H). Three techniques are being explored to make m-Si:C:H films: glow-discharge deposition, thermal annealing of a-Si:C:H films, and laser annealing of a-Si:C:H: films. Preliminary results indicate that laser annealing is the most promising approach.

33119 **(SERI/PR—9296-T1) Cadmium sulfide/copper sulfide heterojunction cell research by sputter deposition. Quarterly technical progress report, December 1, 1980-February 28, 1981.** Thornton, J.A.; Anderson, W.W.; Meakin, J.D. (Solar Energy Research Inst., Golden, CO (USA); TELIC Corp., Santa Monica, CA (USA); Lockheed Palo Alto Research Labs., CA (USA); Delaware Univ., Newark (USA). Inst. of Energy Conversion). 3 Apr 1981. Contract AC02-77CH00178. 50p. NTIS, PC A03/MF A01. Order Number DE81026219.

Photoluminescence spectral measurements on 6000 nm thick reactive sputtered CdS coatings have yielded exciton and green edge emission spectra which are similar in their general character to those recorded from the evaporated CdS that yields high performance cells. The photoluminescence spectra of the sputtered coatings will be correlated with the performance of these materials when used for cells. All-sputter-deposited cells with composite doped and undoped CdS layers have yielded J/sub sc/ ~ 3 mA/cm². This is the highest J/sub sc/ that has been achieved for cells with this structure, which is designed to increase the junction electric field. A hybrid cell with sputtered $Cu_2S$ deposited onto evaporated CdS supplied by IEC has yielded J/sub sc/ ~ 18 mA/cm² (under illumination of 87.5 mW/cm²), V/sub oc/ 0.47V, FF = 0.60, and eta = 5.74% with no AR coating. $Cu_2S$ reactive sputtering experiments have further elucidated the influence of cathode and wall conditioning on the deposition process. CdS reactive sputtering experiments using a planar magnetron source have been initiated. Data are reported on the dependence of the deposition rate and coating resistivity on the substrate temperature and $H_2S$ injection rate. The planar magnetron data are generally consistent with data previously reported for CdS reactive sputtering using cylindrical-post magnetrons. The resistivities of CdS coatings deposited using the planar magnetron are typicaly a factor of from three to ten lower than for coatings deposited using the cylindrical magnetrons. An analysis is reported which relates the frequency dispersion observed in C-V measurements on CdS/$Cu_2S$ solar cells to the surface resistivity of the $Cu_2S$ layer.

33120 **(SERI/TP—233-1388) Photoelectrochemical solar cells: stabilization of small-band-gap semiconductor in aqueous solution by surface-attached organic conducting polymer.** Frank, A.J. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1981. Contract AC02-77CH00178. 13p. (CONF-810864—1). NTIS, PC A02/MF A01. Order Number DE81030312.

From International conference on low-dimensional conductors; Boulder, CO, USA (10 Aug 1981).

Surface-attached polypyrrole films have been shown to produce a marked improvement in the stability of n-type single-crystal and polycrystalline Si against oxidation in an aqueous electrolyte. The current production of n-type polycrystalline Si coated with polypyrrole deteriorates less than 30% during 122 hr of irradiation whereas the unprotected bare electrode stops producing photocurrent within 30 s. The polymer protection of the n-type single-crystal Si is significantly less than that of the polycrystalline material because of differences in the adhesion of the polymer film to the electrode surfaces. The adhesion strength is shown to depend on various surface properties of Si and other electrode materials. Moreover, the surface morphology of the electrode affects the topography of the growing surface of the polypyrrole film. Requirements are discussed for the applications of organic conducting polymers to photoelectrochemical devices utilized for solar energy conversion.

**33121 (SERI/TP—622-1174) Thermal and electrochemical biomass conversion at SERI.** Reed, T.B.; Milne, T.; Desrosiers, R.; Diebold, J.; Chum, H.L. (Solar Energy Research Inst., Golden, CO (USA)). May 1981. Contract AC02-77CH00178. 22p. NTIS, PC A02/MF A01. Order Number DE81030507.

Much of the biomass of the world occurs in a relatively dry form and is most accessible to nonbiological methods of conversion to various energy forms. The Biomass Thermal Conversion and Exploratory Branch at the Solar Energy Research Institute (SERI) has the mission to evaluate various conversion processes, to do basic research in support of these areas, and to develop new processes for the conversion of biomass to fuels and chemicals.

**33122 (TAC/SP—81-002) Solar photovoltaics: a bibliography with abstracts. Quarterly update, April-June 1981.** Sparkman, T.; Bozman, W.R. (eds.). (New Mexico Univ., Albuquerque (USA). Technology Application Center). Jul 1981. 140p. Univ. of New Mexico, Albuquerque. Order Number DE81904061.

This annotated bibliography covers: overviews of photovoltaics, economics, and policy; legal, environmental, health and safety aspects; cell materials, materials properties, and encapsulants; cell fabrication and configuration; cell performance, testing, simulation and modelling; module and array types, fabrication, and performance: applications and complemental hardware; energy storage; and the solar satellite power systems. An author index and a keyword index are included. (LEW)

**33123 Effect of zinc impurity on silicon solar-cell efficiency.** Sah, C.T.; Chan, P.C.H.; Wang, C.K.; Sah, R.L.Y.; Yamakawa, K.A.; Lutwack, R. (Univ of Ill, Urbana). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ;* **ED-28**: No. 3, 304-313(Mar 1981).

This paper projects that in order to get a 17-percent AM1 cell efficiency for the Block IV module of the Low-Cost Solar Array Project, the concentration of the zinc recombination centers in the base region of silicon solar cells must be less than 4 x $10^{11}$ Zn/cm$^3$ in the p-base n/sup +//p/p/sup +/ cell and 7 x $10^{11}$ Zn/cm$^3$ in the n-Base p/sup +//n/n/sup +/ cell for a base dopant impurity concentration of 5 x $10^{14}$ atoms/cm$^3$. If the base dopant impurity concentration is increased by a factor of 10 to 5 x $10^{15}$ atoms/cm$^3$, then the maximum allowable zinc concentration is increased by a factor of about two for a 17-percent AM1 efficiency. 19 refs.

## 1406 Photovoltaic Power Systems

*REFER ALSO TO CITATION(S) 33098, 33102, 33122*

**33124 (DOE/ET/20347—T1) Mississippi County Community College Solar Photovoltaic Project. Final report.** Turner, W.D.; Deaver, F.K.; Johnson, M.M.; Pugh, T.; Snowden, R.; Wall, J.D.; Williams, J.G.; Yeargan, J.R. (Arkansas Univ., Fayetteville (USA)). Nov 1980. Contract FG05-7720347. 256p. NTIS, PC A12/MF A01. Order Number DE81030669.

A weather station was maintained in Blytheville, Arkansas, from April 1978 to April 1980. Daily totals of direct normal and global insolation are given, and an hour-by-hour printout of direct normal, global, and diffuse solar radiation for the entire two year period is included. A number of studies were conducted, including daylighting, energy conservation and management, design tradeoffs, and landscaping. The collector selection process included the writing of specifications, providing design data, reviewing the various collector designs, inspecting potential vendor facilities, monitoring on-site tests, and the final selection. A simulation was made of the entire system, including both an electrical and thermal simulation of the photovoltaic array and a thermal simulation of the various buildings. Example printouts of the simulations are included. (LEW)

**33125 (DOE/JPL/955894—2) Integrated residential photovoltaic array development. Quarterly report No. 2.** Shepard, N.F. Jr. (General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.). 18 May 1981. Contract NAS-7-100-955894. 90p. NTIS, PC A05/MF A01. Order Number DE81021535.

The results of a selection process to define the conceptual design of an optimum integrated residential photovoltaic module array are discussed. Three basic module design concepts have been analyzed with respect to both production and installation costs. The results of this evaluation have been used to synthesize a fourth design which incorporates the best features of these initial concepts to produce a module/array design approach which offers the promise of a substantial reduction in the installed cost of a residential array. A unique waterproofing and mounting scheme has been used to reduce the cost of installing an integral array while still maintaining a high probability that the installed array will be watertight for the design lifetime of the system. This recommended concept will also permit the array to be mounted as a direct or stand-off installation with no changes to the module design.

**33126 (MIT-EL—79-016) Photovoltaic assisted residence with supplemental battery storage: searching for a complementarity.** Dinwoodie, T.L. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). 1979. Contract AC02-76ET20279. 43p. NTIS, PC A03/MF A01. Order Number DE81029734.

A search is conducted for a system control logic which most enhances PV/storage operation and economics, and to use this best logic in a regional analysis of the effects of storage capacity and battery costs on the total system breakeven value. A utility interfaced storage operation without photovoltaics is examined against a tandem (PV-battery) arrangement with a range of utility buy-back policies. Three models are employed in the analysis. The first is a photovoltaic array-battery storage model providing simulation of the system's watt-hour generation characteristics where specific system parameters are input. The second is a load schedule model to simulate appliance energy consumption and use patterns for a typical residence. The third model, the economic valuation, applies fuel escalation, system degradation, and the rated price structure to displaced utility energy figures to determine the net present value of accumulated energy savings over a 20 year period. (LEW)

**33127 (MIT-EL—79-026) Social cost factors and the development of photovoltaic energy systems.** Neff, T.L. (Massachusetts Inst. of Tech., Lexington (USA); Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Oct 1979. Contract AC02-76ET20279. 188p. NTIS, PC A09/MF A01.

The results are presented of a social cost evaluation of three prospective photovoltaic electricity supply technologies. The technologies - based on cadmium sulfide, silicon, and gallium arsenide - are compared with each other and with coal in three categories of direct social impacts: occupational and public health and environmental effects. Indirect impacts, due to opportunity costs and benefits, or to health or other effects of use of material, labor or energy itself, are also considered. Special attention is given to regulatory issues that will arise in connection with these social costs and to their potential importance to government programs and commercial development.

**33128 (MIT-EL—79-042) Availability of capital for developing photovoltaic markets.** Ellis, P. (Massachusetts Inst. of Tech., Lexington (USA); Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Nov 1979. Contract AC02-76ET20279. 33p. NTIS, PC A03/MF A01. Order Number DE81029721.

Capital availability is examined for both the production and consumption sides of this young industry. The experiences of photovoltaic producers in obtaining and allocating capital are described for three groups: oil company photovoltaic subsidiaries, electronic firm subsidiaries, and independent producers. The capital availability problems of solar thermal consumers provide a basis for anticipating such problems for future photovoltaic grid-connected consumers. This basis is used to project the probable behavior of capital markets once mass production is economically feasible.

33129 **(MIT-EL—80-002) Flywheel storage for photovoltaics: an economic evaluation of two applications.** Dinwoodie, T.L. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Feb 1980. Contract AC02-76ET20279. 89p. NTIS, PC A05/MF A01. Order Number DE81029696.

A worth analysis is made for an advanced flywheel storage concept for tandem operation with photovoltaics currently being developed at MIT/Lincoln Laboratories. The applications examined here are a single family residence and a multi-family load center, 8 kWp and 100 kWp, respectively. The objectives were to determine optimal flywheel sizing for the various operating environments and to determine the financial parameters that would affect market penetration. The operating modes included both utility interface and remote, stand-alone logics. All studies were performed by computer simulation. The analysis concludes that flywheel systems are more attractive in residential applications, primarily because of differences in financing parameters and, in particular, the discount rate. In all applications flywheel storage is seen to increase the optimum size of a photovoltaic system. For stand-alone environments, optimum configuration sizing is fairly insensitive to hardware cost of photovoltaics and flywheels for a given reliability when no diesel generator is included. Overall, the worth analysis finds a high sensitivity in the areas of discount rate, PV capital cost, flywheel capital cost, and diesel fuel costs.

33130 **(MIT-EL—80-008) Economics of photovoltaics in the commercial, institutional, and industrial sectors.** Cox, A.J. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Apr 1980. Contract AM01-76EI02295. 24p. (CONF-800159—1). NTIS, PC A02/MF A01. Order Number DE81029735.

From Photovoltaic materials and device measurements workshop; San Diego, CA, USA (3 Jan 1980).

The application is described of a model which computes system break-even capital costs, array break-even capital costs and profits from photovoltaic investments in the industrial, commercial and institutional sectors. Several tax and accounting combinations are described and utilized. Results indicate that, at rates of return usually found in the industrial and commercial sectors, photovoltaic investments will not be attractive when the costs of those investments are based on the Department of Energy's cost goals for 1986.

33131 **(MIT-EL—80-025) Impact on photovoltaic worth of utility rate and reform and of specific market, financial, and policy variables: a commercial/industrial/institutional sector analysis.** Dinwoodie, T.L.; Cox, A.J. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Sep 1980. Contract AC02-76ET20279. 46p. NTIS, PC A03/MF A01. Order Number DE81029698.

An assessment is provided of the economic outlook for photovoltaic systems in the commercial, industrial and institutional sectors in the year 1986. The expected cost and performance goals are summarized for photovoltaic technology, and then aspects of the market and financial environment pertinent to assessment of a photovoltaic investment beginning in that year are estimated. Three geographic regions of the US are covered, characterized by Boston, Madison, and Phoenix, and photovoltaic economic performance is examined when operating against five different means for establishing utility backup rates. The potential of a photovoltaic array to reduce a firm's monthly capacity charge is assessed. For the initial analysis, utilizing a base case set of financial parameters, it is found that a peak-shaving credit attributed to a photovoltaic array can be significant, but not so much as to prove photovoltaics in the commercial sector in 1986. The institutional sector is expected to find photovoltaics profitable if they discount at rates reflective of the returns on long-term government bonds. Sensitivity studies are performed and the impact of combinations of government incentives is examined. (LEW)

33132 **(MIT-EL—81-004) PV1 model verification and validation.** Fuller, F.H.; Lilien, G.L.; Wulfe, M. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jan 1981. Contract AM01-76EI02295. 89p. NTIS, PC A05/MF A01. Order Number DE81029712.

PV1 is a discrete-time, deterministic computer model of market penetration of photovoltaics, available to the user in an interactive mode. A summary description of the model is provided, including its basic computations. The theoretical validation is described. A line-by-line description and verification of the computer code is presented, including a series of hand calculations that are compared to the results obtained PV1. 61 references. (LEW)

33133 **(NASA-CP—2141) Solar power satellite microwave transmission and reception.** Dietz, R.H. (National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center). Dec 1980. 271p. NTIS PC A16/MF A01.

Numerous analytical and experimental investigations related to SPS microwave power transmission and reception are reported. Aspects discussed include system performance, phase control, power amplifiers, radiating elements, rectenna, solid state configurations, and planned program activities.

33134 **(NASA-TM—81622) Commerical (terrestrial) and modified solar array design studies for low cost, low power space applications.** Kolecki, J.C.; Riley, T.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Dec 1980. 21p. NTIS PC A02/MF A01.

The suitability of commercial (terrestrial) solar arrays for use in low Earth orbit is examined. It is shown that commercial solar arrays degrade under thermal cycling because of material flexure, and that certain types of silicones used in the construction of these arrays outgas severely. Based on the results, modifications were made. The modified array retains the essential features of typical commercial arrays and can be easily built by commercial fabrication techniques at low cost. The modified array uses a metal tray for containment, but eliminates the high outgassing potting materials and glass cover sheets. Cells are individually mounted with an adhesive and individually covered with glass cover slips, or clear plastic tape. The modified array is found to withstand severe thermal cycling for long intervals of time.

33135 **(PNL—3853) Photovoltaic product directory and buyers guide.** Watts, R.L.; Smith, S.A.; Mazzucchi, R.P. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1981. Contract AC06-76RL01830. 55p. NTIS, PC A04/MF A01. Order Number DE81030186.

Basic information on photovoltaic conversion technology is provided for those unfamiliar with the field. Various types of photovoltaic products and systems currently available off-the-shelf are described. These include products without batteries, battery chargers, power packages, home electric systems, and partial systems. Procedures are given for designing a photovoltaic system from scratch. A few custom photovoltaic systems are described, and a list is compiled of photovoltaic firms which can provide custom systems. Guidance is offered for deciding whether or not to use photovoltaic products. A variety of installations are described and their performance is appraised by the owners. Information is given on various financial incentives available from state and federal governments. Sources of additional information on photovoltaics are listed. A matrix is provided indicating the sources of various types of photovoltaic products. The addresses of suppliers are listed. (LEW)

33136 **(SAND—81-7014/Vol.1-2) Study of photovoltaic cost elements. Volume 1. Executive report. Volume 2. Project background. Final report.** (Sandia National Labs., Livermore, CA (USA); Barry (Theodore) and Associates, Los Angeles, CA (USA)). Jul 1981. Contract AC04-76DP00789. 269p. NTIS, PC A12/MF A01. Order Number DE81030982.

Two models used for estimating installation costs for residential and intermediate photovoltaic energy systems are summarized. A brief overview of the modeling rationale is provided, and the results obtained when the models were applied to 10 residential and 10 intermediate PV systems are summarized. Output reports for each of the test cases are appended. (LEW)

**33137 (SAND—81-7014/Vol.3) Study of photovoltaic cost elements. Volume 3. Sandia National Laboratories photovoltaic systems design catalog. Final report.** (Sandia National Labs., Livermore, CA (USA); Barry (Theodore) and Associates, Los Angeles, CA (USA)). Jul 1981. Contract AC04-76DP00789. 207p. NTIS, PC A10/MF A01. Order Number DE81030986.

Basic system data sheets, which include project title and location, prime contractor, PV system general description, and energy storage capacity, are shown for 29 intermediate PV systems and 19 residential PV systems. In addition, cost data and output reports generated by TB and A's PV Installation Cost Model have been included for 10 intermediate systems and 10 residential systems.

**33138 (SAND—81-7014/Vol.4) Study of photovoltaic cost elements. Volume 4. Installation cost model for residential PV systems: users manual. Final report.** (Sandia National Labs., Livermore, CA (USA); Barry (Theodore) and Associates, Los Angeles, CA (USA)). Jul 1981. Contract AC04-76DP00789. 89p. NTIS, PC A05/MF A01. Order Number DE81031921.

A quantitative methodology is presented for estimating installation costs of residential photovoltaic systems. The Installation Cost Model for Residential PV Systems is comprised of 144 estimating equations selectively exercised, based on user definition of the system. At the input stage, Residential PV systems can be fully described by 9 design option categories and 9 system specification categories. All assumptions have been validated with installers of solar thermal systems and with TB and A's Architects and Engineers Division. A discussion of the model is included as well as an example of its use with an 8 KW PV system for a Southwest All-Electric Residential design.

**33139 (SAND—81-7014/Vol.5) Study of photovoltaic cost elements. Volume 5. Installation cost model for intermediate PV systems: users manual. Final report.** (Sandia National Labs., Livermore, CA (USA); Barry (Theodore) and Associates, Los Angeles, CA (USA)). Jul 1981. Contract AC04-76DP00789. 137p. NTIS, PC A07/MF A01. Order Number DE81030981.

A cost modeling methodology is presented for estimating installation costs associated with intermediate photovoltaic (PV) systems. With only a parametric description of an intermediate power system, the model can be used to develop an installation cost estimate for that system. The model is based on conventional cost-estimating procedures widely used by the construction industry and was validated by comparing estimates for the same 10 systems made independently by a cost engineering firm. A description of the model is included as well as an example of its use with a 200 KW solar breeder plant design to be located in Rockville, Maryland.

## 1407 Solar Thermal Power Systems

**33140 (ATR—80(7873)-4) Improved effectiveness of solar repowering in the utilities with high coal generation.** Mathur, P. (Aerospace Corp., El Segundo, CA (USA)). May 1980. Contract AC03-80SF10800. 15p. NTIS, PC A02/MF A01. Order Number DE81027231.

Various factors are reviewed which contribute to situations in which oil is not saved by solar repowering. A technical approach to alleviating the adverse effects of such factors is presented. Results of utility economic analyses for an example case are presented to illustrate the approach. (LEW)

**33141 (CONF-7508108—1) 5-Megawatt solar-thermal test facility.** (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA); Black and Veatch Consulting Engineers, Kansas City, MO (USA); Honeywell, Inc., Minneapolis, MN (USA); Georgia Inst. of Tech., Atlanta (USA)). 1975. Contract AC03-79SF10499. 48p. NTIS, PC A03/MF A01. Order Number DE81026270.

From Preliminary conceptual design conference; Albuquerque, NM, USA (18 Aug 1975).

The proposed site for the Central Receiver Test Facility is mapped and the primary tests to be performed are outlined. Seven alternative conceptual designs are diagrammed and their costs are compared. The functions and data for the required buildings are given. The construction schedule is given and long lead procurements are listed. (LEW)

**33142 (DOE/ET/21015—9) Solar radiation flux distributions in cavity receivers.** Hamilton, N.I.; Jarvinen, P.O. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 28 Nov 1979. Contract AC02-78ET21015. 41p. NTIS, PC A03/MF A01. Order Number DE81029707.

Analyses of solar radiation flux distribution in cavity receivers for various cavity geometries are summarized. Simple analytical techniques to calculate the incident solar flux distribution inside the cavities are derived for several cavity shapes to provide a quick, but reasonably accurate analysis of temperature profiles along the walls and backs of cavities. Design strategies to couple a dome-capped ceramic receiver to a dish/Brayton or dish/Stirling engine are also discussed. A steady-state analysis of cavity receivers shows that direct heat-transfer concepts, where heat is drawn off directly to the load, are more efficient than indirect heat-transfer concepts, where heat is withdrawn from a cavity area that does not receive incident solar flux.

**33143 (NASA-CR—163882) Storage requirement definition study. final report.** Stacy, L.E.; Wesling, G.C.; Zimmerman, W.F. (General Electric Co., Cincinnati, OH (USA); Jet Propulsion Lab., Pasadena, CA (USA)). Dec 1980. 120p. NTIS PC A06/MF A01.

A dish Stirling solar receiver (DSSR) and a heat pipe solar receiver with TES (HPSR) for a 25 kWe dish Stirling solar power system are described. The thermal performance and cost effectiveness of each are analyzed minute by minute over the equivalent of one year of solar insolation. Existing designs of these two systems were used as a basis for the study TES concepts for the DSSR and alternative TES concepts for the HPSR are presented. Parametric performance and cost studies were performed to determine the operating and cost characteristics of these systems. Data are reported for systems (1) without TES and with varying amounts of TES, (2) with and without a fossil fuel combustor, (3) with varying solar to fossil power input, and (4) with different system control assumptions. The principal effects of TES duration, collector area, engine efficiency, and fuel cost sensitivity are indicated. Development needs for each of the systems are discussed and the need and nature of possible future TES solar modular experiments are presented and discussed.

**33144 (NASA-CR—163884) Development of simplified process for environmentally resistant cells. Final report, 8 Jun. 1978 - 30 Nov. 1980.** King, W.J. (Jet Propulsion Lab., Pasadena, CA (USA)). Dec 1980. 166p. NTIS PC A08/MF A01.

This report describes a program to develop a simple, foolproof, all vacuum solar cell manufacturing process which can be completely automated and which results in medium efficiency cells which are inherently environmentally resistant. All components of the completed cells are integrated into a monolithic structure with no material interfaces. The exposed materials (SI, Al2O3, Al, Ni) are all resistant to atmospheric attack and the junction, per se, is passivated to prevent long term degradation. Such cells are intended to be incorporated into a simple module consisting basically of a press formed metallic superstructure with a separated glass cover for missile, etc., protection.

**33145 (NASA-CR—163889) Dish Stirling solar receiver program. Final report.** Haglund, R.A. (Jet Propulsion Lab., Pasadena, CA (USA)). Dec 1980. 174p. NTIS PC A08/MF A01.

A technology demonstration of a Dish Stirling solar thermal electric system can be accomplished earlier and at a much lower cost than previous planning had indicated by employing technical solutions that allow already existing hardware, with minimum modifications, to be integrated into a total system with a minimum of development. The DSSR operates with a modified United Stirling p-40 engine/alternator and the JPL Test Bed Concentrator as a

completely integrated solar thermal electric system having a design output of 25 kWe. The system is augmented by fossil fuel combustion which ensures a continuous electrical output under all environmental conditions. Technical and economic studies by government and industry in the United States and abroad identify the Dish Stirling solar electric system as the most appropriate, efficient and economical method for conversion of solar energy to electricity in applications when the electrical demand is 10 MWe and less.

33146 **(SAND—81-0275-Rev.) Heliostat operation at the Central Receiver Test Facility (1978-1980).** Holmes, J.T. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1981. Contract AC04-76DP00789. 25p. NTIS, PC A02/MF A01. Order Number DE81031926.

The data and conclusions are presented for the 222 CRTF heliostats that have been in operation from 1978 through 1980. The CRTF beam produces a total power of 5.5 MWth and a peak intensity of 2250 kW/m$^2$ near solar noon. A new safe operating strategy has recently been implemented. Improvements in the targeting accuracy have been made. The mirror reflectivity is maintained near 80% by cleaning with natural rains or snow. The CRTF heliostats have logged almost 300,000 operating hours by the end of 1980.

33147 **(SAND—81-8236) Comparative economics of solar thermal central receivers.** Fish, M.J. (Sandia National Labs., Livermore, CA (USA)). Aug 1981. Contract AC04-76DP00789. 56p. NTIS, PC A04/MF A01. Order Number DE81029623.

For both electrical and industrial process heat (IPH) generation, central receivers compare favorably with oil and gas, and in many cases, coal. Calculational results are presented in which the levelized energy costs from central receiver plants are compared with those from oil, gas, and coal fired plants. Both electrical and IPH applications are discussed. Uncertainties in future capital costs, fuel price escalation rates, and the underlying economic climate are included in the analysis.

33148 **Corrosion of Fe alloys in NaNo/sub 3/-KNO/sub 3/-NaNO/sub 2/ at 823 K.** Kramer, C.M.; Smyrl, W.H.; Estill, W.b. (Sandia Lab, Livermore, Calif). *Journal of Materials for Energy Systems ;* 1: No. 4, 59-65(Mar 1980).

In support of advanced solar central receiver programs, six iron-based construction materials were exposed to a molten NaNO/sub 2/-NaNO/sub 3/-KNO/sub 3/ salt mixture at 823 K for periods up to six months. After one month of exposure, the amount of oxidation ranged from 10 mg/cm/sup 2/ for low carbon steel to about 0.1 mg/cm/sup 2/ for 310 stainless steel. The low-Cr alloys tended to blister and spall but the stainless steels were more corrosion resistant. Analysis of the oxide surface of a 5 pct chrome alloy indicated a chromium enriched layer was presented at the oxide/metal interface and an iron oxide rich layer at the oxide/nitrate interface. 15 refs.

## 1408 Ocean Thermal Gradient And Salinity Gradient Power Systems

*REFER ALSO TO CITATION(S) 33443, 33830, 33831, 33909*

33149 **(ANL/OTEC-BCM—018) Effect of mechanical cleaning on seawater corrosion of candidate OTEC heat exchanger materials. Part 2. Tests with Amertap sponge rubber balls.** Tipton, D.G. (Argonne National Lab., IL (USA)). Jun 1981. Contract W-31-109-ENG-38. 32p. NTIS, PC A03/MF A01. Order Number DE81029953.

Corrosion evaluations were conducted on 3003 Alclad, C70600 copper-nickel, and commercially-pure titanium in natural seawater under simulated OTEC heat exchanger conditions to investigate the erosion-corrosion effects of mechanical tube cleaning under aggressive over-cleaning conditions. Test conditions for 3003 Alclad included Amertap soft sponge ball cleaning with and without chlorination. Amertap abrasive sponge ball cleaning with and without chlorination, and no mechanical cleaning as a control. C70600 was exposed to Amertap soft sponge ball cleaning with and without chlorination and with no mechanical cleaning as a control. Titanium was cleaned by abrasive Amertap sponge balls with and without chlorination and compared to no mechanical cleaning as a control. Test exposures of 8, 16, 30, 60, 90 and 180 days were made. The sequence of Amertap sponge ball cleaning utilized in the present tests significantly accelerated corrosion of 3003 Alclad. Chlorination brought about a further acceleration of erosion-corrosion of Alclad. Amertap soft sponge ball cleaning of C70600 caused significant acceleration of corrosion under these over-cleaning conditions. Chlorination somewhat decreased erosion corrosion of C70600. Titanium showed no substantial effect of Amertap abrasive sponge ball cleaning on corrosion, although measurable weight losses were incurred. Chlorination had no measurable effect on erosion-corrosion of titanium.

33150 **(DOE/ER/05518—1) Geographic distribution of the OTEC resource off the south and east coasts of the Florida Peninsula.** Sivak, L.D. (Florida Inst. of Tech., Melbourne (USA)). Jun 1978. Contract FG05-77ER05518. 241p. NTIS, PC A11/MF A01. Order Number DE81030023.

A map representation is provided of the thermal resource of the Florida Current area which can be used in the Ocean Thermal Energy Conversion (OTEC) site selection process. The result of this research is a series of charts of the study area showing the geographic distribution of the thermal resource; the temperature difference between the surface waters and the waters at 200 meters, 400 meters, 500 meters, 600 meters and 800 meters, respectively, for each month of the year. A usable thermal resource appears to be present in the area bounded by Miami, the Florida Keys, and Bimini on the north and Cuba on the south, at both the 0-500 meter and 0-600 meter depth intervals from approximately May through November. The thermal resource is too variable in waters shallower than these to be effectively utilized by the OTEC plant configurations presently under consideration by the Department of Energy. It is evident that data coverage is particularly lacking on the Key West region where a sizeable thermal resource appears to be present for the 0 to 800 meter depth interval.

33151 **(DOE/ET/21002—T19) OTEC support services. Quarterly technical progress report No. 13, 15 May 1981-14 August 1981.** (VSE Corp., Alexandria, VA (USA)). Aug 1981. Contract AC02-78ET21002. 13p. NTIS, PC A02/MF A01. Order Number DE81030046.

System integration, system engineering, and management services for the Division of Ocean Energy Systems are briefly described and progress in these areas is described. Objectives of these services include: (1) technical analysis and support of program efforts as an aid in evaluating program status; (2) program technical monitoring; (3) development and implementation of methodology to permit the logical and systematic identification, evaluation, and trade-off for major subsystem configurations; (4) technical assessments; (5) system integration; (6) environment and siting considerations; and (7) transmission subsystem considerations. (LEW)

33152 **(LBL—10511-Vol.1) Ocean thermal energy conversion programmatic environmental analysis.** Sands, M.D. (Lawrence Berkeley Lab., CA (USA); Interstate Electronics Corp., Anaheim, CA (USA)). Jan 1980. Contract W-7405-ENG-48. 212p. NTIS, PC A10/MF A01. Order Number DE81030222.

OTEC technology is reviewed and the existing environment of potential sites is described. The geology, oceanography, and economic profiles of these oceanic, subtropical-tropical regions are studied. The atmospheric effects of releases, particularly carbon dioxide, and sea-surface cooling, and associated climatic effects are projected. Land effects of the construction of plants and transmission cable entry points, and the marine ecosystem impacts caused by the attraction of organisms to the platform, intake and discharge of seawater and discharge of biocides are discussed. The health and safety hazards associated with OTEC, particularly regarding releases of Freon or ammonia, are assessed. Legal and regulatory aspects are discussed. Alternatives considered include the choice of power cycle (open or closed), platform configuration (land-based, moored, or plant-ship), seawater discharge design (separate or mixed releases) and intended power use (baseload electricity or at-sea production of ammonia or aluminum). 331 references. (LEW)

**33153 (LBL—10511-Vol.2) Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices.** (Lawrence Berkeley Lab., CA (USA)). Jan 1980. Contract W-7405-ENG-48. 137p. NTIS, PC A07/MF A01. Order Number DE81030223.

Previously completed OTEC deployment studies are synthesized to describe a projected commercialization scenario. A compendium of oceanographic data for potential OTEC resource areas is provided. The methods or calculations used in the environmental assessment are briefly described. (LEW)

**33154 (LBL—12977) Environmental programs for ocean thermal energy conversion (OTEC).** Wilde, P. (Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 10p. (CONF-810911—2). NTIS, PC A02/MF A01. Order Number DE81028876.

From Oceans 1981 conference; Boston, MA, USA (16 Sep 1981).

The environmental research effort in support of the US Department of Energy's Ocean Thermal Energy Conversion (OTEC) program has the goal of providing documented information on the effect of proposed operations on the ocean and the effect of oceanic conditions on the plant. The associated environment program consists of archival studies in potential areas serial oceanographic cruises to sites or regions of interest, studies from various fixed platforms at sites, and compilation of such information for appropriate legal compliance and permit requirements and for use in progressive design of OTEC plants. Site/regions investigated are south of Mobile and west of Tampa, Gulf of Mexico; Punta Tuna, Puerto Rico; St. Croix, Virgin Islands; Kahe Point, Oahu and Keahole Point, Hawaii, Hawaiian Islands; and off the Brazilian south Equatorial Coast. Four classes of environmental concerns identified are: redistribution of oceanic properties (ocean water mixing, impingement/entrainment etc.); chemical pollution (biocides, working fluid leaks, etc.); structural effects (artificial reef, aggregation, nesting/migration, etc.); socio-legal-economic (worker safety, enviromaritime law, etc.).

**33155 (MIT-EL—79-041) Research on the external fluid mechanics of ocean thermal energy conversion plants. Report covering experiments in stagnant water.** Adams, E.E.; Fry, D.J.; Coxe, D.H.; Harleman, D.R.F. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jun 1979. Contract AS02-78ET20483. 105p. NTIS, PC A06/MF A01. Order Number DE81029648.

The first set of experiments is described in a physical model study to explore plume transport and recirculation potential for a range of generic Ocean Thermal Energy Conversion (OTEC) plant designs and ambient conditions. Tests were conducted in a thermally-stratified 12 m x 18 m x 0.6 m basin, at an undistorted length scale ratio of 1:300, which allowed the upper 180 m of the ocean to be studied. Measurements included temperature, dye concentration and visual observations from still photographs. Conditions which have been tested include a range of plant sizes (nominally 200 MWe to 600 MWe), a range of discharge configurations (mixed vs. non-mixed evaporator and condenser flows; multiple vs. radial slot discharge port(s); variation of discharge-intake separation and variation of discharge angle), and a range of ambient density profiles (characterized by the depth of the surface mixed layer). The tests described herein are for a stagnant ambient ocean. Results have shown no significant recirculation for plant sizes up to 400 MWe for discharges directed either horizontally or with a downward component. However, significant recirculation was observed in a test of a 400 MWe plant in which the discharge was directed with a slight upward component and in a test of 600 MWe plant with a horizontal discharge. No significant difference in recirculation could be discerned between the mixed and the non-mixed discharge designs although substantial variation, in the plume equilibrium position was noted. Measurements of minimum plume dilution taken at approximately 1 km (prototype) from the plant generally fell in the range of 5 to 10 with a mean value of 7.4. This indicates that peak concentrations of any chemicals contained in the discharge would be about 14% of the discharge concentration. Other information, such as the plume shape and equilibrium position, intake temperature changes and perturbations to the ambient ocean profile, are included for each run.

**33156 (ORNL/TM—7438-Vol.2) Ocean thermal energy conversion gas-desorption studies. Volume 2. Deaeration in a packed column and a barometric intake system.** Golshani, A.; Chen, F.C. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 64p. NTIS, PC A04/MF A01. Order Number DE81030469.

After a review of previous relevant studies, the design of a gas desorption test loop and a barometric intake system are described. The results of vacuum deaeration in a packed column and a barometric intake system are presented, and the savings that can be achieved when the packed column and barometric intake system are combined are discussed. Vacuum deaeration laboratory experiments using three different kinds of packings in a packed column test section and a series of barometric intake deaeration experiments are reported. A conceptual OTEC deaeration subsystem design, based on these results, and its implications on an OTEC-open cycle power system are presented. (LEW)

**33157 (SERI/TP—634-1282) Overview and FY 1981 progress on open-cycle OTEC power systems.** Penney, T.R.; Shelpuk, B. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1981. Contract AC02-77CH00178. 7p. (CONF-810911—3). NTIS, PC A02/MF A01. Order Number DE81029277.

From Oceans 1981 conference; Boston, MA, USA (16 Sep 1981).

Progress in an advanced research and development program studying viable alternatives to closed-cycle OTEC is reported. Work on a 100-MWe steam turbine, heat exchangers, and deaeration for Claude- or open-cycle OTEC systems are reported. Capsule descriptions of ocean energy conversion techniques are given, including wave energy conversion, ocean current energy conversion, and salinity gradient energy conversion as well as varieties of ocean thermal energy conversion. (LEW)

## 1409 Solar Thermal Utilization

*REFER ALSO TO CITATION(S) 33076, 33099, 33100, 33101, 33147, 33201*

**33158 (BNL—29970) Comparative thermal performance of direct gain, Trombe, and sunspace walls.** Ghaffari, H.T.; Jones, R.F. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 8p. (CONF-810925—21). NTIS, PC A02/MF A01. Order Number DE81030546.

From 6. national passive conference; Portland, OR, USA (8 Sep 1981).

The natural thermal storage features of the Brookhaven superinsulated house are analyzed and verified. These include the Trombe and sunspace passive-solar-collection walls and the superinsulated south-facing wall, denoted herein as the direct-gain wall. The thermal contributions of each system on the basis of the in-field empirical data are demonstrated. Several thermal characteristic factors, in relation to each design for the hourly and daily period, are assessed. Further, the interior temperature fluctuations and the reductions in the required auxiliary energy with regard to incorporated passive designs are evaluated.

**33159 (BNL—51394) Comparative economic performance of selected passive solar heating and cooling technologies.** Rutter, W. (Brookhaven National Lab., Upton, NY (USA). National Center for Analysis of Energy Systems). May 1981. Contract AC02-76CH00016. 24p. NTIS, PC A02/MF A01. Order Number DE81030220.

The economic performance of selected passive solar heating and cooling technologies which incorporate energy storage is assessed by using a set of uniform assumptions and methodologies. Where data are available, a given system is assessed at more than one geographical location. Results are obtained in the form of both payback period and net present value for residential applications, and in terms of net present value only for industrial/commercial uses. Results indicate that ventilated trombe walls, solar roof ponds, and certain night effect/floor storage strategies are cost effective, but night effect/rock bed cooling is not. Results also show that, although direct gain out-performs trombe walls in most parts of the country, both direct gain and trombe walls usually produce a net

savings in the residential sector. Generally, however, tax regulations result in net economic loss for direct gain and trombe walls used to heat industrial and commercial buildings.

33160 **(CONF-810912—(Prelim.)) Annual DOE active solar heating and cooling contractors' review meeting. Pre-meeting proceedings and project summaries.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Sep 1981. 286p. NTIS, PC A13/MF A01. Order Number DE81028052.

From Annual DOE active solar heating and cooling contractor's review meeting; Washington, DC, USA (Sep 1981).

Ninety-three project summaries are presented which discuss the following aspects of active solar heating and cooling: Rankine solar cooling systems; absorption solar cooling systems; desiccant solar cooling systems; solar heat pump systems; solar hot water systems; special projects (such as the National Solar Data Network, hybrid solar thermal/photovoltaic applications, and heat transfer and water migration in soils); administrative/management support; and solar collector, storage, controls, analysis, and materials technology. (LEW)

33161 **(CONF-811034—1) Performance predictions of passive solar commercial buildings.** Kurkowski, T.L. (Argonne National Lab., IL (USA); USDOE Chicago Operations Office, Argonne, IL). 1981. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01. Order Number DE81027979.

From 2. national technical conference on earth sheltered buildings; Tulsa, OK, USA (16 Oct 1981).

Many earth bermed and high mass commercial structures tending to require cooling and lighting rather than heating have been designed, built, and instrumented to record segregated or partitioned energy usage. Design solutions, preliminary performance, and cost information are addressed for the earth integrated projects.

33162 **(DOE/CS/30209—T4) Telephone, mail, and personal questionnaires for data collection.** (OR/MS Dialogue, Inc., Cambridge, MA (USA)). 20 Feb 1980. Contract AC03-79CS30209. 78p. NTIS, PC A04/MF A01. Order Number DE81029308.

Forms used in conducting a national survey about solar energy are presented. Forms for representatives from the domestic, commercial, and industrial sectors, owners and non-owners of solar equipment, are shown. Participants were to be contacted by telephone, mail, and personal visits. (MCW)

33163 **(DOE/CS/32197—T1) Solar production of industrial process steam: TRW/ORE-Ida potato processing project, Phase I. Final report.** Cherne, J. (TRW Systems Group, McLean, VA (USA)). 21 May 1979. Contract AC03-78CS32197. 174p. (SAN—2191-1). NTIS, PC A08/MF A01. Order Number DE81023642.

The results of the Phase I analysis and design portion of the TRW Energy Systems Group/Ore-Ida Foods project to use solar energy in the potato processing industry are presented. The system concept calls for concentrating solar collectors to collect heat which will be transferred to a flash steam generator where steam will be produced and delivered to a potato fryer heat exchanger. This steam will supplement steam generated by fossil-fuel boilers which also supplies other fryers - the latter will be used for energy consumption comparison. The concept includes no storage.

33164 **(DOE/NASA/CR—161830) Solar heating and hot water system installed at James Hurst Elementary School, Portsmouth, VA. Final Report.** (Portsmouth Public Schools, VA (USA)). Jul 1981. Contract FC01-78CS05205. 167p. NTIS, PC A08/MF A01. Order Number DE81030142.

The building was zoned into 4 heating/cooling areas. Each area was equipped with an air handling unit that is monitored and controlled by a Honeywell DELTA 1000 Central Control and Monitoring System. The solar system for the building uses a collector area of 3,630 sq. ft. of flat plate liquid collectors, and a 6,000 gallon storage tank. Included are system descriptions, maintenance reports, detailed component specifications, and the design drawings necessary to evaluate this solar system.

33165 **(DOE/QQ/04038—T1) Study guide for fundamentals of solar heating: a correspondence course for the air conditioning industry.** (Sheet Metal and Air Conditioning Contractors National Association, Vienna, VA (USA)). Aug 1978. Contract AC01-77QQ04038. 115p. (HCP/M—4038-02-Rev.). NTIS, PC A06/MF A01. Order Number DE81029667.

This revision is the August 1978, reprinting of HCP/M4038—02, which has appeared previously.

33166 **(DOE/SF/11511—T1) Heating and cooling applications of atriums and attached greenhouses. A state-of-the-art report.** (Eureka Labs., Inc., Sacramento, CA (USA)). Dec 1980. Contract AC03-80SF11511. 113p. NTIS, PC A06/MF A01. Order Number DE81022181.

The objective of the project is to collect experimental data to be used in correlating algorithms on volumetric airflow rates and heat transfer rates in atrium design. This initial report describes the current-state-of-the-art in atrium designs and reports its deployment status throughout the US. Individual and computer subject searches of atriums and greenhouse were completed. An annotated bibliography of each reference reviewed was prepared and are listed in three categories: system characteristics; existing attached greenhouses and atriums, and current greenhouse design criteria. Atriums are defined; a classification scheme is developed; and operating modes are discussed. Atrium locations are identified by region. The sites are plotted in Section 5. Section 6 discusses simplified approaches to sizing atrium elements, emphasizing greenhouse materials. Appendix A presents system details on a representative cross-section of the various greenhouse system types currently used in the US. (MCW)

33167 **(DOE/TIC—1027977) Guidebook for solar process-heat applications.** Fazzolare, R.; Mignon, G.; Campoy, L.; Luttmann, F. (Arizona Solar Energy Research Commission, Phoenix (USA)). Jan 1981. 169p. NTIS, PC A08/MF A01. Order Number DE81027977.

The potential for solar process heat in Arizona is reviewed and some of the general technical aspects of solar are explored, such as insolation, siting, and process analysis. The major aspects of a solar plant design are then presented to include general discussions of collectors, storage, and heat exchange. Reducing hardware costs to annual dollar benefits is discussed. Rate of return, cash flow, and pay-back, which are well known criteria in management decisions, are discussed as they relate to solar systems. Finally, a case study of design analysis procedures is presented. The design-cost optimization techniques using a yearly computer simulation of a solar process operation is demonstrated.

33168 **(IS-M—334) Transwall research.** McClelland, J.F. (Ames Lab., IA (USA)). 1981. Contract W-7405-ENG-82. 2p. (CONF-810832—6). NTIS, PC A02/MF A01. Order Number DE81028925.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The overall project goal is to advance component and materials technologies necessary for an improved passive solar building conditioning system based on the Transwall concept described below. This system could provide significant advantages over present Trombe wall and direct gain systems by avoiding the window blocking aspect of the former while reducing the over exposure problems often experienced with the latter. The technical problems being addressed are related to: (1) system thermal performance and reliability, (2) economy of fabrication, installation, and maintenance, and (3) aesthetic appeal and building integration. Progress on the research and technical accomplishments is discussed. (MCW)

33169 **(IS-M—345) Transwall: a modular visually transmitting thermal storage wall. Status report.** McClelland, J.F.; Mercer, R.W.; Hodges, L.; Szydlowski, R.F.; Sidles, P.H.; Struss, R.G.; Hull, J.R.; Block, D.A. (Ames Lab., IA (USA); Argonne National Lab., IL (USA); Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Architecture). 1980. Contract W-7405-ENG-82. 8p. (CONF-8008123—1). NTIS, PC A02/MF A01. Order Number DE81029821.

From International Solar Energy Society conference; Brighton, UK (24 Aug 1980).

Transwall is a semitransparent thermal storage wall system that offers a number of advantages over conventional direct-gain and Trombe wall approaches. Progress is reported in the design, fabrication, installation, and operation of a glass and aluminum prototype system. A facility for year-round performance testing of the system is described and preliminary summer-season thermal test data are presented. Thermal performance modeling results are also reported that predict heat loss reduction with a heat mirror coating on Transwall to be comparable to that obtained with R6 night insulation.

33170 **(LA-UR—81-2500) Passive-solar retrofit study for the United States Navy.** Wray, W.O.; Miles, C.R. (Los Alamos National Lab., NM (USA); Naval Civil Engineering Lab., Port Hueneme, CA (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810865—3). NTIS, PC A02/MF A01. Order Number DE81030250.

From Solar world forum; Brighton, UK (23 Aug 1981).

A passive solar retrofit study has been conducted for the United States Navy at the Los Alamos National Laboratory. The purpose of the study was to determine the energy savings obtainable in concrete block buildings from several passive solar heating strategies. A procedure involving the use of test cell data and computer simulation was employed to assess the merits of six retrofit options. The six strategies selected were chosen on the basis of providing a series of options that will deliver increasing energy savings at the cost of correspondingly increased levels of commitment.

33171 **(LA-UR—81-2518) Heating remote rooms in passive solar buildings.** Balcomb, J.D. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810865—2). NTIS, PC A02/MF A01. Order Number DE81030247.

From Solar world forum; Brighton, UK (23 Aug 1981).

Remote rooms can be effectively heated by convection through a connecting doorway. A simple steady-state equation is developed for design purposes. Validation of a dynamic model is achieved using data obtained over a 13-day period. Dynamic effects are investigated using a simulation analysis for three different cases of driving temperature; the effect is to reduce the temperature difference between the driving room and the remote room compared to the steady-state model. For large temperature swings in the driving room a strategy which uses the intervening door in a diode mode is effective. The importance of heat-storing mass in the remote room is investigated.

33172 **(LBL—11387) Verification of BLAST by comparison with measurements of a solar-dominated test cell and a thermally massive building.** Andersson, B.; Bauman, F.; Carroll, W.; Kammerud, R.; Friedman, N. (Lawrence Berkeley Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 12p. (CONF-810405—17). NTIS, PC A02/MF A01. Order Number DE81029883.

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

As part of an ongoing effort to use empirical data to test the computational accuracy of the building energy analysis computer program BLAST, two verification studies are reported. In the first, comparisons between temperatures measured in a direct solar gain test cell and temperatures predicted by the program have been made. The comparisons were performed for two distinct climate periods; the simulations were driven by weather data collected at the test cell site in Los Alamos, New Mexico. The test cell configuration and weather data manipulations are described; quantitative evaluations of the comparisons between measured and predicted interior temperatures are presented; limitations of the comparisons are discussed; and sensitivities of the simulation results to uncertainties in the measured parameters are examined. In the second study, comparisons of BLAST predictions to temperatures and loads measured in a massive structure have been carried out. These tests represent a first step in verifying the program's ability to: (1) calculate full-scale building loads; and (2) accurately model hybrid cooling using forced ventilation. The structure, its controlled external environment, and the tests conducted are described; results of completed comparisons and anticipated future simulations are discussed.

33173 **(LBL—12048) Incremental cooling load determination for passive direct gain heating systems.** Sullivan, P.W.; Mahone, D.; Fuller, W.; Gruber, J.; Kammerud, R.; Place, W.; Andersson, B. (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 5p. (CONF-810509—40). NTIS, PC A02/MF A01. Order Number DE81029882.

From Annual conference of the International Solar Energy Society; Philadelphia, PA, USA (26 May 1981).

This paper examines the applicability of the National Association of Home Builders (NAHB) full load compressor hour method for predicting the cooling load increase in a residence, attributable to direct gain passive heating systems. The NAHB method predictions are compared with the results of 200 hour-by-hour simulations using BLAST and the two methods show reasonable agreement. The degree of agreement and the limitations of the NAHB method are discussed.

33174 **(LBL—13054-Rev.) Overview of active solar absorption/Rankine cooling program.** Wahlig, M.; Heitz, A.; Angerman, H.; Glas, R.; Warren, M. (Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 7p. (CONF-810912—13(Rev.)). NTIS, PC A02/MF A01. Order Number DE81028041.

From Annual DOE active solar heating and cooling contractor's review meeting; Washington, DC, USA (Sep 1981).

The individual absorption and Rankine projects are identified, along with the main features and accomplishments/status of each and future plans. Included are four projects funded by SOLERAS, a joint US/Saudi Arabian effort. In the absorption program, there are three active component development projects, four systems field test projects, one advanced fluid study project and one advanced cycle study project currently funded by DOE. In the Rankine program, there are five active component development projects, two system field test projects, and one advanced study project. (LEW)

33175 **(MASEC-CF—81-019) Vocational-technical instructors passive-solar training workshop.** (Mid-American Solar Energy Complex, Minneapolis, MN (USA)). Jul 1981. Contract AC02-79CS30150. 24p. (P—101-7). NTIS, PC A02/MF A01. Order Number DE81030055.

The successful efforts to provide training to instructors who teach residential design and construction at vocational-technical (vo-tech) schools are described. The training was directed toward those techniques one must consider when designing and/or constructing an energy efficient passive solar home.

33176 **(MASEC-CF—81-023) Solar energy training program for code enforcement personnel.** (Mid-American Solar Energy Complex, Minneapolis, MN (USA)). Jun 1981. Contract AC02-79CS30150. 17p. (P—101-12/A-101-4). NTIS, PC A02/MF A01. Order Number DE81030053.

The Mid-American Solar Energy Complex assisted the Council of American Building Officials (CABO) in a training program for building code officials. In 1979, CABO coordinated the development of a new model building code for solar, developed course materials, and designed a detailed manual to inform code officials about the basics of passive and active solar energy and the model code. The pilot course was held in November, 1980, in Michigan, selected as the target state. The announcement of the Michigan training program and the list of registrants are presented. (MCW)

33177 **(MASEC-CF—81-035) Summary of passive solar multi-family design workshops.** (Mid-America Solar Energy Center, Minneapolis, MN (USA)). Jun 1981. Contract AC02-79CS30150. 14p. (P—103-4). NTIS, PC A02/MF A01. Order Number DE81030353.

An outline of the workbook used for the workshops is presented, along with a list of the workshops. Promotional activities are described briefly. (MHR)

33178 **(MASEC-PA—80-007) MASEC Solar 80 home designs.** (Mid-American Solar Energy Complex, Bloomington, MN (USA)). 1980. 19p. NTIS, PC A02/MF A01. Order Number DE81028344.

The plan book shows and describes passive solar homes designed by ten teams from various sections of the mid-American region. The energy efficient designs use up to 80% less fossil fuel energy for heating than those built to conventional construction standards. Energy conserving and passive design techniques are discussed. The design features of the ten (RidgeWay, ClaireMont, SolarWay, KirkWood, SunSource, ParkLand, CedarWood, SunRise, SunCrest, and WaterFord) homes are presented. (MCW)

33179 **(MASEC/R—81-045) Evaluation of the passive solar for agriculture program.** (Mid-American Solar Energy Complex, Minneapolis, MN (USA)). Sep 1981. Contract AC02-79CS30150. 5p. (P—107-1). NTIS, PC A02/MF A01. Order Number DE81030056.

The purpose of this program is to stimulate the use of passive and hybrid solar energy for farm homes. Redirection of DOE emphasis limited the FY '81 program to information transfer on the topic to requesting groups and individuals.

33180 **(MASEC/R—81-059/1) Quarterly report of solar federal buildings program in the MASEC region.** (Mid-American Solar Energy Complex, Minneapolis, MN (USA)). Jun 1981. Contract AC02-79CS30150. 20p. NTIS, PC A02/MF A01. Order Number DE81027968.

MASEC staff members contacted agencies coordinating the Solar Federal Buildings Program (SFBP) within the 12-state MASEC region (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin). SFBP agencies with projects in the region submitted all information available about the projects. This information (program coordinator, proposal number, and project status) is presented for projects in each state. Information was also disseminated concerning a SFBP Short Course August 17-21, 1981. (MCW)

33181 **(MIT-EL—79-045) Solar heating and cooling standard setting: an institutional analysis case study.** Nutt-Powell, T.E.; Wagner, J. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Aug 1979. Contract AC02-76ET20279. 34p. NTIS, PC A03/MF A01. Order Number DE81029608.

Results are reported of an institutional analysis case study of the effort to create solar thermal standards during the period 1974-78. The standards setting institutional arena is described. In the US, most standards are achieved through a voluntary consensus process; there are mandatory standards only when referenced or formally adopted by a governmental body. The justification most frequently offered for having two systems is that the voluntary consensus approach resolves primarily technical issues, while the mandatory system encompasses political questions. It is found that the solar standards development process from 1974-78 was characterized by a horizontal rather than vertical structure; extensive public prompting, albeit by agencies for which standards development is at best a secondary mission; rapid acceptance of the concept of solar energy, despite continuing and considerable technical debate. It is concluded that the development of standards is a story of the interaction of self-interest, and that the failure to account for significant interests (whether technical or political) can effectively scuttle a standard development effort. For the case reported, the process for the development of solar standards was inclusive of many interests, and, as a consequence, appeared to proceed at a rapid rate. However solar standards development is entering a second stage, with the consumer/producer debate (the political dimension) assuming a more central role.

33182 **(MIT-EL—80-024) Institutional analysis of the solar heating and cooling residential demonstration program.** Nutt-Powell, T.E. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Apr 1980. Contract AC02-76ET20279. 33p. NTIS, PC A03/MF A01. Order Number DE81029703.

The results are summarized of a study of the institutional factors influencing solar acceptance in a variety of settings. In particular it presents an institutional analysis of the Solar Heating and Cooling Demonstration Program in the residential sector. The paper presents a coherent picture of the program's design, implementation, and outcomes in order to promote an understanding of the implications of each for the design of programs to facilitate rapid acceptance of innovations such as photovoltaics in the residential sector.

33183 **(NESEC—9) Solar consumer assurance: an assessment of mechanisms in the Northeast.** Walsh, R.W. (Northeast Solar Energy Center, Boston, MA (USA)). May 1981. Contract AC02-80CS30149. 88p. NTIS, PC A05/MF A01. Order Number DE81030052.

Results and analysis of assessments of current and proposed consumer assurance mechanisms in solar energy in the nine Northeast states served by the Northeast Solar Energy Center are reported. Mechanisms are categorized according to the following objectives: the informal consumer, the competent installer, assuring product quality and performance, and responsiveness to consumer grievances. (MHR)

33184 **(NP—1903997) Optimization of solar heating and cooling systems.** Freeman, T.L. (International Energy Agency, 75 - Paris (France)). Jun 1981. 56p. NTIS (US Sales Only), PC A04/MF A01.

A review of general techniques and specific methods useful in the optimization of solar heating and cooling systems is undertaken. A discussion of the state of the art and the principal problems in both the simplified thermal performance analysis and economic analysis portions of the optimization problem are presented. Sample economic analyses are performed using several widely used economic criteria. The predicted thermal results of one typical, widely used simplified method is compared to detailed simulation results. A methodology for and the results of a sensitivity study of key economic parameters in the life cycle cost method are presented. Finally, a simple graphical optimization technique based on the life cycle cost method is proposed.

33185 **(SAND—81-0373) Solar thermal energy: abstracts of a special seminar for industry.** Alvis, R.L. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 28p. (CONF-810260—1). NTIS, PC A03/MF A01. Order Number DE81029136.

From Special seminar for industry on solar thermal energy; Albuquerque, NM, USA (3 Feb 1981).

The abstracts of the papers presented at the Modular Industrial Solar Retrofit (MISR) Conference in Albuquerque, New Mexico are compiled. The papers discuss the technology status of line-focus solar thermal systems and the solar industrial process heat field test program, MISR market survey and land use, MISR system specifications, guidelines, contracting plans, site selection/field experiments, data acquisition and results reporting, and supplier/user system evaluation. (LEW)

33186 **(SERI/TR—98288-1) Parametric sensitivity study for solar-assisted heat-pump systems. Final report.** White, N.M.; Morehouse, J.H. (Solar Energy Research Inst., Golden, CO (USA); Science Applications, Inc., McLean, VA (USA). Solar Technology Div.). Jul 1981. Contract AC02-77CH00178. 110p. NTIS, PC A06/MF A01. Order Number DE81030309.

A sensitivity study is performed of the engineering and economic parameters affecting life-cycle costs for solar-assisted heat pump systems. The change in energy usage resulting from each engineering parameter varied has been developed from computer simulations, and is compared with results from a stand-alone heat pump system. Three geographical locations are considered: Washington, DC, Fort Worth, TX, and Madison, WI. Results indicate that most engineering changes to the systems studied do not provide significant energy savings. The most promising parameters to vary are the solar collector parameters tau $\alpha$ and U/sub L/ the heat pump capactiy at design point, and the minimum utilizable evaporator temperature. Costs associated with each change are estimated, and life-cycle costs computed for both engineering parameters and economic variations in interest rate, discount rate, tax credits, fuel unit costs and fuel inflation rates. Results indicate that none of the feasible engineering changes for the system configuration studied will make these systems economically competitive with the stand-alone heat pump without a considerable tax credit.

**33187 (SOLAR/1041—81/14) Solar energy system performance evaluation: Forest City Dillon, Washington, DC, January 1980-December 1980.** Missal, D.W. (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). 1980. Contract AC01-79CS30027. 82p. NTIS, PC A05/MF A01. Order Number DE81028174.

An active solar energy system consisting of 2592 square feet of single-glazed flat-plate collectors, 3200 gallons of storage liquid, and an auxiliary oil-fired boiler, is designed to supply 59% of the hot water demand for a high rise apartment building. The annual solar fraction predicted by the f-chart simulation was 37%, and the solar fraction measured was 32%. Other measures of performance, including solar savings ratio, conventional fuel savings, system performance factor, and solar system coefficient of performance, are given. The performance of the collector, storage, and domestic hot water subsystems is discussed. The operating energy of the system and weather data are given. (LEW)

**33188 (SOLAR/1045—80/14) Solar energy system performance evaluation: Montecito Pines, Santa Rosa, California, November 1979-April 1980.** Ashman, E.N. (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). 1980. Contract AC01-79CS30027. 80p. NTIS, PC A05/MF A01. Order Number DE81028175.

An active solar energy system consisting of 950 square feet of flat-plate collectors, gas-fired auxiliary boilers, and 2000 gallons of storage is designed to supply 46% of the heating load and 37% of the hot water load for an apartment complex. The solar fractions actually achieved were 11% for heating and 44% for hot water. Other measures of performance are given, including solar savings ratio, conventional fuel savings, system performance factor, and solar system coefficient of performance. The performance of the collector, storage, space heating and domestic hot water subsystems are discussed. The operating energy of the system and weather data are given. (LEW)

**33189 (SOLAR/1060—81/14) Solar energy system performance evaluation: Cathedral Square, Burlington, Vermont, January 1980-December 1980.** Cramer, M. (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). 1980. Contract AC01-79CS30027. 81p. NTIS, PC A05/MF A01. Order Number DE81029986.

An active solar energy system composed of 1798 square feet of liquid flat-plate collectors, a 360-cubic-foot, stone-lined steel storage tank, and two natural-gas-fired auxiliary boilers, is designed to supply 51% of the hot water load for a 10-story apartment building. Large losses during circulation to the load caused the measured solar fraction to be only 12%. Other measures of performance, including solar savings ratio, conventional fuel savings, operating cost, system performance factor, and solar coefficient of performance, are also given. The performance of the collector, storage, and domestic hot water subsystems is also discussed. The total system operating energy and weather data are given. (LEW)

**33190 (SOLAR/2008—81/14) Solar energy system performance evaluation: Aratex Services, Fresno, California, December 1979-November 1980.** Howard, B.D. (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). 1980. Contract AC01-79CS30027. 124p. NTIS, PC A06/MF A01. Order Number DE81029985.

Solar preheated water is supplied to a commercial laundry plant by an active system consisting of 6528 square feet of single glazed flat-plate collectors, 12,500-gallon fiberglass storage tank, auxiliary steam boilers, and a 16,500-gallon water pump with tube-shell heat exchanger for feedwater preheat. The system is designed to provide 20% of the water heating load by solar energy. The solar fraction measured is 18%. Other measures of performance are given, including solar savings ratio, conventional fuel savings, system performance factor, and solar coefficient of performance. The collector, storage, laundry hot water, and heat recovery subsystem performances are also discussed. The laundry's operating energy and weather data are given. (LEW)

**33191 (DOE/SF/11446—T1) Commercialization survey for the Department of Energy's solar buildings demonstration program.** (Stephens Engineering Co., Inc., McLean, VA (USA); Planning and Management Associates of Greater Washington, Inc., DC (USA)). [nd]. Contract AC03-80SF11446. 22p. NTIS, PC A02/MF A01. Order Number DE81028302.

The report presents a summary of the results of an effort to develop a commercialization strategy for the Department of Energy's Solar Buildings Demonstration Program. The project investigated various commercial demonstration projects funded by DOE from an effective point of view and makes specific recommendations concerning continuing or discontinuing the activities of these projects. An overall strategic approach to future directions of the program is addressed. (MCW)

## 1410 Solar Collectors And Concentrators

*REFER ALSO TO CITATION(S) 33097, 33146*

**33192 (DOE/CS/30174—T2Vol.1) Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981.** Ochs, T.; Stojanoff, C.G.; Day, D.L.; Eckert, E.; Langeliers, J.; Wruck, D. (Nevada Univ., Boulder City (USA). Desert Research Inst.). May 1981. Contract AC04-79CS30174. 98p. NTIS, PC A05/MF A01. Order Number DE81030820.

The actual phenomena taking place in the saturated pond are studied. Experimental procedures for solar ponds are presented. In an attempt to summarize the physical properties of salt solutions an exhaustive literature search was conducted. The first part consists of basic definitions of terms and a summary of the properties of pure water. Data are tabulated on a number of binary aqueous solutions (one salt and water). (MHR)

**33193 (DOE/ET/21015—11) Edge stresses in spherical-shell solar receivers.** Sheldon, D.B. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 18 Jan 1980. Contract AC02-78ET21015. 68p. NTIS, PC A04/MF A01. Order Number DE81029713.

The suitability of using spherical silicon carbide shells as heat exchangers in solar energy receivers is investigated. The responses of several such shells to the required thermal and pressure loads are examined quantitatively. Shells of different edge diameters, depth, and thicknesses are considered. Numerical data are presented which describe the maximum tensile and compressive stresses arising from heat-transfer requirements and the shells' nominal diurnal temperature cycle. These data describe the stresses resulting from a range of edge conditions. Relatively simple minimum-stress boundary conditions are identified. The characteristics of a pressure seal and edge-support mechanism that permit these minimum-stress boundary conditions to be realized are discussed. The temperature of the middle surface of each shell and the temperature gradient through its thickness are assumed to be uniform over the entire shell. Two design approaches avoid large deviations from the minimum-stress boundary conditions: (1) hemispherical shells can be freely supported; and (2) shallow shells can be restrained by a clamp that accommodates changes in the diameter and rotation of a shell's edge. These designs are compatible with minimizing the effects of thermal transients whose time scale is substantially shorter than the diurnal cycle.

**33194 (DOE/R5/10223—2) Midwest appropriate technology small grants program. Semi-annual technical progress report.** (Indiana Laborers' Training Trust Fund, Bedford (USA)). 17 Aug 1981. Contract FG02-80R510223. 33p. NTIS, PC A03/MF A01. Order Number DE81028152.

The use of thermocouples in collectors is investigated using an experimental air collector and liquid collector. Experiments in heat storage, using coke as compared to rock, are reported. A high-temperature concentrating thermocouple collector is proposed. (LEW)

33195 **(SAND—81-0369) Performance testing of the TOLTEC TI-410 concentrating solar collector.** Dudley, V.E.; Workhoven, R.M. (Sandia National Labs., Albuquerque, NM (USA); EG and G, Inc., Albuquerque, NM (USA)). Jul 1981. Contract AC04-76DP00789. 55p. NTIS, PC A04/MF A01. Order Number DE81029994.

Results of tests conducted by the Collector Module Test Facility on a Toltec TI-410 Solar Collector are summarized. Collector efficiency, thermal loss, and receiver differential pressure were measured at fluid temperatures from 20°C to 200°C. The collector was evaluated with a glass mirror and with an acrylic/polyester film reflector surface. Four different receiver designs were tested.

33196 **(SAND—81-8177-Exec.Summ.) Second generation heliostat program.** (Sandia National Labs., Livermore, CA (USA); McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). Apr 1981. Contract AC04-76DP00789. 15p. NTIS, PC A02/MF A01. Order Number DE81029752.

The development and demonstration of a production design and production plans for the MDAC heliostat are summarized, including the selected heliostat configuration and design, site assembly, testing, maintenance, the production facility, volume heliostat price, and possible future cost reductions. (LEW)

33197 **(SAND—81-8177-Vol.1) Second generation heliostat. Final report.** Steinmeyer, D.A. (Sandia National Labs., Livermore, CA (USA); McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). Apr 1981. Contract AC04-76DP00789. 428p. NTIS, PC A19/MF A01. Order Number DE81029618.

The heliostat subsystem design is described. The test program is summarized, including component testing, subsystem operation at MDAC-Huntington Beach, and the shipment and installation at the Central Receiver Test Facility. The production heliostat description, the manufacturing process definitions, and the manufacturing facility definition are summarized. The installation, operations, and maintenance requirements for the 50 MWe field are summarized. Results are given of the cost analysis of the MDAC Second Generation Heliostat when produced at an annual rate of 50,000 units per year and installed and operated in a field of 5412 heliostats. Possible future development activities aimed at further cost reduction are discussed. (LEW)

33198 **(SAND—81-8177-Vol.2) Second generation heliostat. Volume II. Definition of a heliostat manufacturing facility. Final report.** (Sandia National Labs., Livermore, CA (USA); McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA); General Motors Technical Center, Warren, MI (USA)). Apr 1981. Contract AC04-76DP00789. 183p. NTIS, PC A09/MF A01. Order Number DE81029824.

The heliostat design is described. A study is performed to provide the definition of a heliostat manufacturing facility capable of producing 50,000 heliostats per year and to generate the manufacturing costs associated with that level of production. The heliostat plant site, plant layout, and cost of the plant are discussed. The manufacture of heliostats, including special requirements for the heliostat mirror, and production costs are given. (LEW)

33199 **(SERI/RR—641-615) Optical transparency of inexpensive salt solutions for construction of density-gradient ponds.** Webb, J.D. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1981. Contract AC02-77CH00178. 54p. NTIS, PC A04/MF A01. Order Number DE81030832.

A laboratory testing protocol has been developed that will permit a comparative evaluation of the optical performance of candidate salts for use in stabilizing solar ponds. Extinction coefficients measured for the salts and for water in dual-beam spectrophotometer fitted with 10-cm quartz sample cells were input to a digital model that convolutes a solar spectrum with an assumed salt/water concentration gradient similar to that to be established in the solar pond. The model determined the fraction of available solar energy transmitted to the pond storage layer. This information was used to estimate the size of the pond needed to meet a given set of thermal demands if the candidate salt were to be used. One candidate salt, a by-product from a flue-gas desulfurization process, was tested according to this protocol. Results indicated that this salt would perform poorly in comparison to commercially available sodium chloride; however, a sensitivity analysis revealed sources of error in the spectrophotometric measurement procedure, which may have led to an unduly pessimistic prediction of performance. These errors are being corrected, and this and other candidate salts will be subject to further evaluation for use in ponds to be constructed on-site.

33200 **Numerical approach to the flux density integral for reflected sunlight.** Lipps, F.W. (Univ of Houston, Tex). *Solar Energy ;* **24**: No. 5, 461-469(1980).

The new approach proposed assumes isotropic gaussian guidance errors. Hence, the flux density integral reduces to several iterated single integrals which can be precalculated and stored in a table for interpolation as needed. The LBL solar telescope data are fed into a convolution integral which represents the guidance errors. Auerole effects can be switched on or off at this point. A vector of convoluted solar data is input to another integration which gives the table of normalized flux contributions. The tabular values depend on the position of the flux point with respect to an edge of the heliostat as seen in the image plane. The image map of the heliostat is linear unless ripples or irregularities occur; hence, effects due to canting and dishing can be included by a ray trace of the heliostat vertices. 13 refs.

## 1420 Heat Storage

*REFER ALSO TO CITATION(S) 33148, 33373, 33374*

33201 **(SAND—81-8184) Conceptual design selection and development of a latent-heat thermal-energy-storage subsystem for a saturated-steam solar receiver and load.** (Sandia National Labs., Livermore, CA (USA); Combustion Engineering, Inc., Windsor, CT (USA). Advanced Development Dept.; Comstock and Wescott, Inc., Cambridge, MA (USA)). Feb 1981. Contract AC04-76DP00789. 307p. (CEND—389). NTIS, PC A14/MF A01. Order Number DE81029622.

The following latent heat storage concepts are described and evaluated in comparison with each other and with an oil/rock sensible heat storage system: (1) passive tube intensive (shell-and-tube heat exchanger) with and without heat transfer enhanced by fins; (2) phase change material cans (or chubbs) with a biphenyl intermediate heat transfer fluid; (3) phase change material macroencapsulation in a containment tank full of tubes; (4) microencapsulation in a porous carrier; (5) direct contact heat exchange; and (6) systems using mechanical scrapers for removing solidified phase change material from container surfaces. A tube intensive system with heat transfer enhancement was selected, and the conceptual design and cost/performance estimates are given for it. A commercial scale unit is assessed, and design changes and corresponding costs are presented that would be required to make the system meet changed requirements. (LEW)

33202 **(SERI/TP—620-1344) SERI Solar-Energy-Storage Program.** Wyman, C.E. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1981. Contract AC02-77CH00178. 3p. (CONF-810912—11). NTIS, PC A02/MF A01. Order Number DE81029476.

From Annual DOE active solar heating and cooling contractor's review meeting; Washington, DC, USA (Sep 1981).

The SERI Solar Energy Storage Program is summarized. The program provides research, systems analysis, and assessments of thermal energy storage and transport in support of the Thermal Energy Storage Program of the DOE Division of Energy Storage Technology; emphasis is on thermal energy storage for solar thermal power and process heat applications and on thermal energy transport. Currently, research is in progress on direct-contact thermal energy storage and thermochemical energy storage and transport. In addition, SERI is directing the definition of new concepts for thermal energy storage and supporting research on thermal energy transport by sensible and latent heat media. SERI is performing systems analyses of thermal energy storage for solar thermal application and coordinating thermal energy storage activities for solar applications.

**33203 (SERI/TP—631-1163) Design and economics of direct-contact salt hydrate storage systems.** Wright, J.D. (Solar Energy Research Inst., Golden, CO (USA)). May 1981. Contract AC02-77CH00178. 9p. (CONF-811007—3). NTIS, PC A02/MF A01.

From 2. world congress of chemical engineering; Montreal, Canada (4 Oct 1981).

A salt-hydrate latent heat storage system is described in which oil is injected at the bottom of the container and exchanges heat as it floats to the top where it is pumped back to the heat source. Experiments are described which are meant to solve two problems. The first problem is to reliably inject the oil into the salt phase. The second is to minimize the carryover of salt hydrate into the oil, which can be done using two-stage coalescer-filters. Three systems are described and compared: a standard liquid-based sensible heat storage system, a latent heat storage design where oil is the heat-transfer fluid throughout the system, and a latent heat storage system where ethylene glycol/water is used in the collectors and oil in the storage tank. Direct-contact latent heat systems have overall costs roughly equal to those for water thermal storage tanks. The primary advantage of latent heat storage is its substantially smaller volume requirement. (LEW)

# 15 GEOTHERMAL ENERGY

*REFER ALSO TO CITATION(S) 33399*

**33204 (ERDA—77-9) Geothermal Energy Research, Development and Demonstration Program. First annual report.** (Energy Research and Development Administration, Washington, DC (USA). Div. of Geothermal Energy). Apr 1977. 232p. NTIS, PC A15/MF A01. Order Number DE81029873.

The following are discussed: program achievements and progress, interagency coordination and program management, international cooperation program, non-federal activities, and future program plans. (MHR)

## 1501 Resource Status And Assessment

*REFER ALSO TO CITATION(S) 33221*

**33205 (DOE/ET/27167—T1) Geothermal resources development project: Phase I.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 30 Sep 1979. Contract FG03-78ET27167. 67p. NTIS, PC A04/MF A01.

Generic and site specific issues and problems are identified that relate directly to geothermal development in California, including changes in the state permitting process, land use issues, coordination between state entities, and geothermal revenues from BLM leased lands. Also discussed are the formation of working groups, preparation of a newsletter, the economic incentives workshops, and recommendations for future actions. (MHR)

**33206 (DOE/EV/10072—5) Multi-task support to the Division of Geothermal Energy's hydrothermal resources program. Final report.** (Gruy Federal, Inc., Arlington, VA (USA)). May 1981. Contract AC08-80NV10072. 14p. NTIS, PC A02/MF A01. Order Number DE81030369.

Information-dissemination tasks in FY 1980 included widespread distribution of a general report on eastern geothermal resources prepared in FY 1979; preparation of state-specific reports on geothermal resources in Illinois, Indiana, Michigan, and Minnesota; a survey of the geothermal potential at military bases throughout the United States; and other minor activities.

**33207 (DOE/NV/10039—3) Low-to-moderate temperature geothermal resource assessment for Nevada, area specific studies. Final report, June 1, 1980-August 30, 1981.** Trexler, D.T.; Koenig, B.A.; Flynn, T.; Bruce, J.L.; Ghusn, G. Jr. (Nevada Bureau of Mines and Geology, Reno (USA)). 1981. Contract AC08-79NV10039. 223p. NTIS, PC A10/MF A01. Order Number DE81030487.

Four papers and an introduction are included. A separate abstract was prepared for each paper. (MHR)

**33208 (DOE/NV/10039—3, pp 191-196) Statewide geothermal resource assessment.** Ghusn, G. 1981. NTIS, PC A10/MF A01. Order Number DE81030487.

In Low-to-moderate temperature geothermal resource assessment for Nevada, area specific studies. Final report, June 1, 1980-August 30, 1981.

During the statewide assessment phase of study to update the geothermal resources map, 23 new fluid chemistries and temperatures were added to the file; several wells and springs throughout the state are not listed in the file because they could not be found or because they were inaccessible.

**33209 Look at the Upper Wilcox Rosita Delta system of South Texas.** Edwards, M.B. (Univ of Tex, Austin). *Oil and Gas Journal ;* **78**: No. 19, 197-205(12 May 1980).

The investigation to locate sandstone reservoirs for the production of geothermal energy is based largely on the detailed correlation of approximately 500 well logs and a commercially available structure map on the top of the Wilcox. The three individual delta complexes comprising the Rosita Delta system are briefly described: the Duval Delta, the Zapata Delta, and the Live Oak Delta.

## 1502 Geology And Hydrology Of Geothermal Systems

*REFER ALSO TO CITATION(S) 33047, 33215, 33216, 33217*

**33210 (LBL—11566, pp 87-89) Role of numerical models in applications to thermohydrological flow in fracture rock masses.** Faust, C.R.; Mercer J.W. (GeoTrans, Inc., Herndon, VA). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

Model applications to thermohydrological flow in fractured media are not likely to be straightforward. The physical processes are complicated, the field systems often difficult to understand, and data for model verification are generally lacking. The primary use for models in this area will be in gaining a better understanding of the physical processes and in conceptualizing the behavior of actual systems. Modeling studies of complex physical systems are generally unable to completely explain all details of observed behavior. In addition to uncertainties associated with interpretation of field measurements of subsurface conditions, numerical models, no matter how sophisticated, are approximations to nature. Because of these uncertainties, model calibration requires either subjective evaluation or statistical treatment. Statistical procedures for history matching of complex numerical models have not been sufficiently developed. This will necessitate the setting of subjective guidelines for model calibration. A model based on subjective history matching procedures and incomplete data is obviously not a unique description of the system. Predictions will consequently have limited credibility. Qualitative predictions and sensitivity analysis still play an important role under such circumstances.

**33211 (LBL—11566, pp 99-101) SHAFT79.** Pruess, K. (Lawrence Berkeley Lab., CA). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

SHAFT79 (Simultaneous Heat And Fluid Transport) is an integrated finite difference program for computing two-phase nonisothermal flow in porous media. SHAFT79 solves the same equations as an earlier version, called SHAFT78, but uses much more efficient mathematical and numerical methods. The principal application for which SHAFT79 is designed is in geothermal reservoir simulation.

33212 (LBL—11566, pp 102-110) **Numerical model CCC.** Bodvarsson, G.S.; Lippmann, M.J. (Lawrence Berkeley Lab., CA). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

The computer program CCC (conduction-convection-consolidation), developed at Lawrence Berkeley Laboratory, solves numerically the heat and mass flow equations for a fully saturated medium, and computes one-dimensional consolidation of the simulated systems. The model employs the Integrated Finite Difference Method (IFDM) in discretizing the saturated medium and formulating the governing equations. The sets of equations are solved either by an iterative solution technique (old version) or an efficient sparse solver (new version). The deformation of the medium is calculated using the one-dimensional consolidation theory of Terzaghi. In this paper, the numerical code is described, validation examples given and areas of application discussed. Several example problems involving flow through fractured media are also presented.

33213 (LBL—11566, pp 90-98) **Geothermal reservoir simulation capabilities at Systems, Science, and Software.** Pritchett, J.W. (Systems, Science, and Software, La Jolla, CA). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

Systems, Science, and Software's basic multiphase multidimensional compositional geothermal reservoir simulator is the MUSHRM code. The capabilities of this computer code are outlined, and applications of the program over the years are summarized. In addition, the CHARM (useful for chemical waste disposal calculations) and LIGHTS (for single-phase long-term reservoir response simulations) codes are available. A typical application of MUSHRM to calculate the response of the Wairakei geothermal field in New Zealand is shown. The simulation involved a 2-D vertical section, located as shown and the known discharge history was imposed. The computational grid and stratigraphy employed are illustrated. Favorable comparison between observed and computed pressure histories in the main part of the reservoir is shown. The observed spatial variation in pressure drop compares well with the corresponding computed pressure distribution. The spatial extent of the two-phase (water/steam) region at Wairakei is shown to have increased with time, and this behavior is reproduced by the computed results. Reasonably good qualitative agreement with the observed discharge enthalpy histories was also obtained: the disagreement is believed to be due to three-dimensional effects not taken into account in this simulation.

## 1503 Geothermal Exploration And Exploration Technology

*REFER ALSO TO CITATION(S) 33207, 33208*

33214 (CONF-811026—8) **Pleasant Bayou No. 2: a review of rationale, ongoing research and preliminary test results.** Morton, R.A. (Texas Univ., Austin (USA). Bureau of Economic Geology). 1981. Contract AC08-79ET27111. 9p. NTIS, PC A02/MF A01. Order Number DE81029798.

From 5. geopressured-geothermal energy conference; Baton Rouge, LA, USA (13 Oct 1981).

The first well designed and drilled to evaluate Gulf Coast geopressured geothermal energy resouces was completed in 1979. Since then, the well has been tested and has entered a long-term production phase intended to provide data on pressure and fluid behavior and reservoir life. Preliminary results indicate that the producing reservoir has good permeability, is extensive, and meets most of the criteria and subsurface conditions predicted prior to drilling, with one exception; salinity is twice what was expected and consequently, methane solubility is about 25% lower than expected. Extensive logging and coring operations as well as continuous monitoring of production and injection activities have provided a wealth of data for ongoing research in areas of geological resource assessment, sandstone diagenesis, rock mechanics, reservoir simulation, reservoir engineering, chemical analyses of produced fluids, scaling and corrosion of equipment, disposal of spent brines, environmental considerations, economics, and commercial development of the resource.

33215 (DOE/NV/10039—3, pp 11-82) **Hawthorne study area.** Koenig, B.A. 1981. NTIS, PC A10/MF A01. Order Number DE81030487.

In Low-to-moderate temperature geothermal resource assessment for Nevada, area specific studies. Final report, June 1, 1980-August 30, 1981.

The Hawthorne study area is located in Mineral County, Nevada. General geologic studies demonstrate the lithologic diversity in the area; these studies also indicate possible sources for dissolved fluid constituents. Geophysical investigations include aeromagnetic and gravity surveys which aid in defining the nature of regional, and to a lesser extent, local variations in subsurface configurations. Surface and near-surface structural features are determined using various types of photo imagery including low sun-angle photography. An extensive shallow depth temperature probe survey indicates two zones of elevated temperature on opposite sides of the Walker Lake basin. Temperature-depth profiles from several wells in the study area indicate significant thermal fluid-bearing aquifers. Fluid chemical studies suggest a wide spatial distribution for the resource, and also suggest a meteoric recharge source in the Wassuk Range. Finally, a soil-mercury survey was not a useful technique in this study area. Two test holes were drilled to conclude the area resource assessment, and thermal fluids were encountered in both walls.

33216 (DOE/NV/10039—3, pp 83-159) **Paradise Valley study area.** Flynn, T. 1981. NTIS, PC A10/MF A01. Order Number DE81030487.

In Low-to-moderate temperature geothermal resource assessment for Nevada, area specific studies. Final report, June 1, 1980-August 30, 1981.

Geothermal fluids in the Paradise Valley study area in north central Nevada range in temperature from 40° to 70°C (106° to 158°F), and discharge at moderates rates from tuffa-cemented sediment mounds. Discharge occurs at or near the intersection of linear and curvilinear features which were identified on both Landsat imagery and contoured gravity data. Steep gravity gradients were identified near thermal fluid discharge areas, but could not be correlated with fault scarps on the surface. Soil-mercury surveys were largely inconclusive because of interference from sources of detrital mercury from nearby mines. Two-meter depth temperature probe surveys indicate that thermal fluids do not influence the temperature regime outside tthe immediate area of discharge. Two groups of thermal fluids were identified on the basis of chemical and stable-light isotope compositions. Both groups of thermal fluids have limited compositional variation and are also chemically distinct from the geothermal fluids. Chemical geothermometers are used to predict a maximum temperature of 94°C (202°F) for thermal fluids near the town of Golconda. Thermal fluids are isotopically lighter than surrounding non-thermal fluids and probably originated as precipitation at elevations above 2500 meters (8200 ft). Isothermal temperature gradients were measured in wells adjacent to thermal fluids. Temperature measurements in wells outside the area of thermal fluid discharge show positive geothermal gradients of approximately 35°C/km. Combined data sets suggest that geothermal fluids in Paradise Valley are deeply-circulating meteoric waters heated by average basin and range geothermal gradients.

33217 (DOE/NV/10039—3, pp 161-189) **Southern Carson Sink study area.** Bruce, J.L. 1981. NTIS, PC A10/MF A01. Order Number DE81030487.

In Low-to-moderate temperature geothermal resource assessment for Nevada, area specific studies. Final report, June 1, 1980-August 30, 1981.

A geothermal assessment study of the southern Carson Sink, Nevada was requested following an inquiry by the US Navy to study the feasibility of establishing a district space heating system at the Fallon Naval Air Station. Geological and geochemical data were collected and field studies were undertaken to evaluate an area greater than 600 sq km (232 sq. mi). Tasks conducted during this program include aerial image analysis, microgravity survey, soil-mercury survey, fluid chemistry studies, and temperature gradi-

ent studies of existing wells. A shallow geothermal anomaly was identified using temperature gradient techniques in the eastern portion of the study area with approximately 70°C (158°F) fluid temperatures at depths less than 50 meters (164 ft). A gravity survey indicated that this resource exists along a basin and range fault, substantiating the theory that the geothermal fluids migrate along fault planes. The soil-mercury survey showed an area of anomalously high mercury values directly above and slightly north of the resource in an area of high geothermal gradients. This suggests that a deeper, hotter resource exists beneath the shallow, moderate temperature resource.

33218 **(LA-UR—81-1765) High-temperature logging for basic development of HDR reservoirs.** Mathews, M.; Pettitt, R.A.; Miles, D.J. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-811015—7). NTIS, PC A02/MF A01. Order Number DE81025371.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

The second phase of the Hot Dry Rock (HDR) Geothermal Development Program at Fenton Hill, New Mexico, consists of two boreholes, directionally-drilled in a northeast direction, inclined at an angle of 35°, with a vertical separation of 365 m (1200 ft). The two boreholes will be connected by 12 to 15 vertical parallel fractures to make a geothermal reservoir calculated to produce 20 MW(e) for 20 years. Accurate temperature measurements, borehole caliper logs, and directional surveys are required for the successful development and operation of this man-made system. Obtaining these data is extremely difficult because of the bottom hole static temperature of 335°C (635°F) at a depth of 4660 m (15,289 ft), the 35° deviation, the abrasive formation, and the presence of sticky drilling residue products. The efforts during July, August, and September 1980, to obtain these data are presented as a case history. The temperature logs and borehole directional survey produced realistic results; but the borehole caliper measurements were inconsistent and unreliable, due to the developmental stage of the caliper tools.

33219 **(LA-UR—81-1807) Hot dry rock geothermal prospects, 1981.** Goff, F.E.; Laughlin, A.W.; Aldrich, J. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-811015—8). NTIS, PC A02/MF A01. Order Number DE81025305.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

The hot dry rock (HDR) site selection and resource evaluation team has been assessing roughly 24 sites within the USA as candidates for development of a second HDR geothermal system. Potential sites examined fall broadly into three categories according to the nature of their thermal anomalies: (1) Quaternary magmahydrothermal (volcanic or igneous) systems such as The Geysers-Clear Lake region, California; (2) regional thermal anomalies of tectonic origin such as the Basin and Range Province of the Southwest; and (3) pre-Quaternary plutonic and metamorphic complexes such as the Conway Granite, New Hampshire. Although sites with both electrical generation and direct use potential have been considered, efforts were concentrated on electrical sites. Criteria for a successful HDR electrical generation site utilizing current technology require temperatures $\geqq$ 200°C, depths $\leqq$ 5/km, and impermeable reservoir rocks. Sites with these characteristics only exist in the western USA. The significance of other criteria such as environmental issues, water rights, public visability, and pre-existing power networks have not yet been evaluated.

33220 **(PNL—3801) Techniques for geothermal liquid sampling and analysis.** Kindle, C.H.; Woodruff, E.M. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1981. Contract AC06-76RL01830. 102p. NTIS, PC A06/MF A01. Order Number DE81030151.

A methodology has been developed that is particularly suited to liquid-dominated resources and adaptable to a variety of situations. It is intended to be a base methodology upon which variations can be made to meet specific needs or situations. The approach consists of recording flow conditions at the time of sampling, a specific insertable probe sampling system, a sample stabilization procedure, commercially available laboratory instruments, and data quality check procedures.

33221 **(UCRL—52980) Comparative assessment of five potential sites for magma: hydrothermal systems - geophysics.** Kasameyer, P. (Lawrence Livermore National Lab., CA (USA)). 2 Sep 1980. Contract W-7405-ENG-48. 56p. NTIS, PC A04/MF A01. Order Number DE81030637.

As part of a comparative assessment for the Continental Scientific Drilling Program, geophysical data were used, to characterize and evaluate potential magma-hydrothermal targets at five drill sites in the western United States. The sites include Roosevelt Hot Springs, Utah, the Rio Grande Rift, New Mexico, and The Geysers-Clear Lake, Long Valley, and Salton Trough areas, California. This summary discusses the size, depth, temperature, and setting of each potential target, as well as relvant scientific questions about their natures and the certainty of their existence.

33222 **(UCRL—86148) Airborne and field-temperature surveys compared at Long Valley KGRA, California.** Del Grande, N.K. (Lawrence Livermore National Lab., CA (USA)). 1 Jun 1981. Contract W-7405-ENG-48. 5p. (CONF-811015—13). NTIS, PC A02/MF A01. Order Number DE81027652.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

An airborne predawn radiometric temperature survey was flown over the Long Valley KGRA. Radiometric temperatures were recorded at 10 to 12 μm and 4.5 to 5.5 μm. They were corrected to obtain true land-surface temperatures in agreement with field data. After accounting for thermal effects from surface features, there remained a thermal anomaly. The anomalous zone encompassed 2 km². It was a dry land area with a predawn surface temperature which averaged 1.4 +- 0.3°C warmer than ambient. This area coincided with a thermal discharge zone where deep temperature gradients were 5 to 30 times normal. The predawn radiometric survey clarified and supplemented conclusions drawn from 6 to 30m deep field surveys. Heat from hydrothermal discharge was stored in a shallow aquifer and conducted to the surface.

## 1507 By-products

33223 **(UCRL—86515) High-pressure solvent extraction of methane from geopressured fluids.** Quong, R.; Otsuki, H.H.; Locke, F.E.; Netherton, R. (Lawrence Livermore National Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 6p. (CONF-811026—2). NTIS, PC A02/MF A01. Order Number DE81027713.

From 5. geopressured-geothermal energy conference; Baton Rouge, LA, USA (13 Oct 1981).

Solvent extraction is propsed as a means of recovering dissolved methane from geopressured-geothermal brines at high pressures. Our assessment shows that additional investment in a high pressure solvent extraction plant preceding direct injection disposal of brines into isolated aquifers can be profitable. The technical and economic issues are discussed and compared with other injection methods such as complete depressurization for methane recovery followed by conventional mechanical pumping. The contributions of hydraulic (pressure) energy recovery and geothermal power production are also assessed. As a first step in the evaluation of solvent extraction, the solubilities of a promising solvent candidate, n-hexadecane, and a potential low cost solvent, No. 2 Diesel fuel, were measured in 15 wt % NaCl solutions at temperatures up to 150°C. Preliminary results of initial extraction tests at 150°C and 1000 psi in sub-pilot scale equipment are also presented.

## 1508 Geothermal Power Plants

33224 **(DOE/ET/28443—T15) Design guide for Geothermal Test Facility.** Lombard. G.L. (San Diego Gas and Electric Co., CA (USA)). 20 Aug 1974. Contract AC03-76ET28443. 106p. NTIS, PC A06/MF A01. Order Number DE81026271.

The intent of this design guide is to provide the engineer with the necessary information to produce a design for a workable installation. It contains a project scope, specific design information, and project control procedures. The desired process is to flash the geothermal brine to steam in three or four stages and transfer the

steam heat energy to the working fluid circulating in closed loop. (MHR)

33225 **(EGG—2110) Semiannual progress report for the Idaho Geothermal Program, October 1, 1980 to March 31, 1981.** Parker, J.T.; Smith, C.J. (eds.). (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1981. Contract AC07-76ID01570. 33p. NTIS, PC A03/MF A01. Order Number DE81030200.

Modifications incorporated in the 5-MW Pilot Power Plant at Raft River Geothermal Test Site, system operational testing and maintenance and activities at that plant, and the water treatment program's corrosion studies are summarized. Progress is reported on performance tests of the ORNL condenser in the Prototype Power Plant, checkout of the direct contact heat exchanger, and modification of that plant. The progress of testing and continuing studies of direct-contact heat exchangers is reported - including the liquid-liquid direct contact heat exchanger, primary heat exchanger, sieve tray preheater, multiple-purpose apparatus, and packed bed studies and tests. Effects of production-injection tests at Raft River on monitor wells are summarized. Monitoring activities and studies of the environmental program at Raft River are described and plans of two successful proposers under the User-Coupled Confirmation Drilling Program are summarized. Investigation of costs for three aspects of direct use of hydrothermal energy is reported. Progress is reported on the Marketing Assistance Program, through which technical information and assistance are provided to potential users and developers of geothermal resources.

## 1509 Geothermal Engineering

33226 **(DOE/ET/27225—9) Flow in geothermal wells. Part IV. Transition criteria for two-phase flow patterns.** Bilicki, Z.; Kestin, J. (Brown Univ., Providence, RI (USA). Div. of Engineering). Dec 1980. Contract AC02-79ET27225. 22p. NTIS, PC A02/MF A01. Order Number DE81028312.

Detailed considerations justifying the criteria for transitions between flow patterns are presented. The following are covered: transition from bubble to plug (or slug) flow, transition from plug flow to froth flow, transition from froth to annular mist flow, and model comparisons. (MHR)

33227 **(DOE/ET/28359—T1) Two-phase flow in geothermal energy sources. Final technical report.** (Denver Research Inst., CO (USA); Coury and Associates, Denver, CO (USA); Houston Univ., TX (USA)). Jul 1981. Contract AS02-76ET28359. 240p. NTIS, PC A11/MF A01. Order Number DE81029037.

A geothermal well consisting of single and two-phase flow sections was modeled in order to explore the variables important to the process. For this purpose a computer program was developed in a versatile form in order to be able to incorporate a variety of two phase flow void fraction and friction correlations. A parametric study indicated that the most significant variables controlling the production rate are: hydrostatic pressure drop or void fraction in the two-phase mixture; and, heat transfer from the wellbore to the surrounding earth. Downhole instrumentation was developed and applied in two flowing wells to provide experimental data for the computer program. The wells (East Mesa 8-1, and a private well) behaved differently. Well 8-1 did not flash and numerous shakedown problems in the probe were encountered. The private well did flash and the instrumentation detected the onset of flashing. A Users Manual was developed and presented in a workshop held in conjunction with the Geothermal Resources Council.

33228 **(LA—8855-HDR) Hot dry rock geothermal energy development program. Annual report, fiscal year 1980.** Cremer, G.M. (comp.). (Los Alamos National Lab., NM (USA)). Jul 1981. Contract W-7405-ENG-36. 216p. NTIS, PC A10/MF A01. Order Number DE81028517.

Investigation and flow testing of the enlarged Phase I heat-extraction system at Fenton Hill continued throughout FY80. Temperature drawdown observed at that time indicated an effective fracture of approximately 40,000 to 60,000 $m^2$. In May 1980, hot dry rock (HDR) technology was used to produce electricity in an interface demonstration experiment at Fenton Hill. A 60-kVA binary-cycle electrical generator was installed in the Phase I surface system and heat from about 3 kg/s of geothermal fluid at 132°C was used to boil Freon R-114, whose vapor drove a turboalternator. A Phase II system was designed and is now being constructed at Fenton Hill that should approach commercial requirements. Borehole EE-2, the injection well, was completed on May 12, 1980. It was drilled to a vertical depth of about 4500 m, where the rock temperature is approximately 320°C. The production well, EE-3 had been drilled to a depth of 3044 m and drilling was continuing. Environmental monitoring of Fenton Hill site continued. Development of equipment, instruments, and materials for technical support at Fenton Hill continued during FY80. Several kinds of models were also developed to understand the behavior of the Phase I system and to develop a predictive capability for future systems. Data from extensive resource investigations were collected, analyzed, and assembled into a geothermal gradient map of the US, and studies were completed on five specific areas as possible locations for HDR Experimental Site 2.

33229 **(LA—8954-MS) Relaxation of geothermal-reservoir stresses induced by heat production.** Murphy, H.; Aamodt, R.; Fisher, H. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 34p. NTIS, PC A03/MF A01. Order Number DE81032024.

Fifteen million kWh of thermal energy were produced during 281 days of operation of the hot dry rock (HDR) geothermal reservoir at Fenton Hill, New Mexico. Following this heat production the thermal stresses and strains so induced were partially released by a short, 7-h pressurization of the reservoir above the local tectonic confining stress. Following the partial stress release, it was found that the resistance to water flow through the reservoir was decreased by 37%, and that the reservoir volume, as measured by tracer studies, increased by 43%. Microseismic events recorded with geophones in two deep wells at positions within a few hundred meters of the reservoir were concentrated in those regions of the reservoir most affected by thermal depletion. These events define a reservoir region and size in qualitative agreement with estimates based upon heat production modeling.

33230 **(SAND—80-0933) Power-law rheology and flow behavior of low-invasion coring fluids.** McGuire, P.L. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 42p. NTIS, PC A03/MF A01. Order Number DE81030998.

An improved pressure coring system has been developed in which an extremely viscous polymer mud is extruded by the core and is used to seal and protect the core from flushing by drilling fluids. The polymer mud must be extremely viscous to minimize invasion, yet must be extruded through a long, narrow annular gap with a minimum of pressure buildup. A highly non-Newtonian shear-thinning polymer is utilized in the low invasion coring fluid. This paper describes the measurement and modeling of non-Newtonian rheology from rotary viscometer data in detail since the simplified equations which are generally used with these instruments can be grossly in error. The development of both an approximate analytical solution and an exact numerical solution of the non-Newtonian extrusion process is presented. These solutions were used to optimize the non-Newtonian rheology of the low-invasion fluid which will be used in actual coring operations.

33231 **Status report--hot dry rock geothermal energy.** Nunz, G.J. (Los Alamos Sci Lab, NM). *Mechanical Engineering ;* **102**: No. 12, 26-31(Nov 1980).

The only alternative energy source that is both enormous in magnitude and potentially developable to a significant extent within this century is geothermal. In the U.S., almost all of this energy exists as heat in "dry" rock (lithologic formations that will not spontaneously produce hot water or steam). It is estimated that the total energy content of the formations underlying the 50 states, to a depth of 10 km and at "commercially interesting" temperatures above 150/degree/C, is about 13.2 million quads, or about 170 thousand times the present total annual consumption of energy in the U.S. Of this practically infinite geothermal resource base, virtually all--more than 99 percent--exists in hot dry rock (HDR). If

only 2 percent were recoverable as was assumed in the Energy Research and Development Administrations's "Scenario I" (1975), it would be sufficient to provide the entire nontransportation energy requirement of the U.S. for over 2000 years at the present rate of consumption. This article describes the efforts of the Los Alamos Scientific Laboratory in a combined development and demonstration program whose elements include: characterizing the resource; cataloging promising sites; developing the reservoir technology and required tools and instruments; attacking the institutional problems; assessing the economics; and demonstrating (at pilot-plant scale) both the technological and economic feasibility of the concept in several geological settings. 2 refs.

33232 **Geothermal well testing.** Narasimhan, T.N.; Witherspoon, P.A. (Univ. of California, Berkeley). Contract W-7405-ENG-48. *Journal of Hydrology ;* **43**: 537-553(1979).

While the techniques of production testing and interference testing already developed in hydrogeology and petroleum engineering provide a strong foundation for geothermal well testing, the latter is challenged by some special problems. These special problems stem primarily from the difficulties associated with the measurement of mass flow rate, pressure and temperature under the hostile environment prevalent within geothermal wells. This paper briefly looks into the state-of-the-art of geothermal well testing and provides a few illustrative field examples.

## 1510 Direct Energy Utilization

33233 **New Mexico State University campus geothermal demonstration project: an engineering construction design and economic evaluation. Final technical report, February 25, 1980-April 24, 1981.** Cunniff, R.A.; Ferguson, E.; Archey, J. Las Cruces, NM; New Mexico State University (Jul 1981). 258p. (NP—1903906; EMD—2-68-2207). New Mexico Energy and Minerals Dept., Santa Fe.

A detailed engineering construction cost estimate and economic evaluation of low temperature geothermal energy application for the New Mexico State University Campus are provided. Included are results from controlled experiments to acquire design data, design calculations and parameters, detailed cost estimates, and a comprehensive cost and benefit analysis. Detailed designs are given for a system using 140 to 145°F geothermal water to displace 79 billion Btu per year of natural gas now being burned to generate steam. This savings represents a displacement of 44 to 46 percent of NMSU central plant natural gas consumption, or 32 to 35 percent of total NMSU natural gas consumption. The report forms the basis for the system construction phase with work scheduled to commence in July 1981, and target on-stream data of February 1982.

## 1520 Geothermal Data And Theory

*REFER ALSO TO CITATION(S) 33220*

## 16 Tidal Power

*REFER ALSO TO CITATION(S) 33399*

# 17 WIND ENERGY

*REFER ALSO TO CITATION(S) 33091, 33093, 33399, 33433*

## 1701 Availability (climatology)

*REFER ALSO TO CITATION(S) 33243, 33246, 33250, 33386*

33234 **(PNL-SA—9149) Wind speed simulation for economic evaluation of wind energy conversion systems.** Ramsdell, J.V.; Athey, G.F.; Ballinger, M.Y. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1981. Contract AC06-76RL01830. 14p. (CONF-810742—3). NTIS, PC A02/MF A01. Order Number DE81030077.

From 4. U.S. national conference on wind engineering research; Seattle, WA, USA (26 Jul 1981).

A time series model has been developed for the simulation of wind speeds. The model provides for the incorporation of systematic seasonal variation of the mean speed, standard deviation, and correlation of speeds. It also provides for incorporation of the systematic diurnal variation of the mean speed and the standard deviation. As a demonstration of the model capabilities, a number of simulations have been made using model parameters derived from data collected at the Hanford Meteorology Station. The results of analyses of both sets of data, the simulated set and the real data, have been compared. In general the major features found in the analyses of the real data are identifiable in the corresponding analyses of the simulated data. The primary difference between the two data sets is in the frequency of high wind speeds. The frequencies of hourly and daily average wind speeds greater than 2 standard deviations above the mean are underestimated slightly by the model.

33235 **Estimation of time series models for horizontal wind on the Norwegian west coast.** Eidsvik, K.J. (Norwegian Inst. for Air Research, Lillestroem). *Wind Engineering ;* **5**: No. 2, 66-72(1981).

Time series of horizontal wind sampled at 5 min intervals on the Norwegian west coast are analyzed. Power spectra are estimated by fitting autoregressive models to the data. Akaike's identification procedure is used. As usual, the low frequency energy dominates the power spectrum, particularly during the winter season. The minimum 5-min prediction error for wind, estimated to ca 1 $ms^{-1}$, appears to vary less with the season than the spectral intensity at the lower frequencies.

33236 **Comparison of height extrapolation models and sensitivity analysis.** Mikhail, A.S. (Solar Energy Research Inst., Golden, CO); Justus, C.G. *Wind Engineering ;* **5**: No. 2, 91-107(1981).

A brief description is given of the different techniques for height extrapolation of wind speed. One of these techniques, the similarity model, is based on Monin-Obukhov similarity theory (Mikhail, 1978). Other models examined are the empirical velocity-dependent power law model (power law model) (Justus, 1976) and the semi-empirical modified velocity-dependent power law model (Text) (modified power law model). Other empirical models examined are: 1/7 power law model, logarithmic model and the linear model suggested by Peterson and Hennessey (1977). Meteorological tower data from Kennedy, Argonne and nine nuclear power plant sites which include stability information were used to compare the similarity model (stability dependent) and the modified power law model.

33237 **Wind power prospecting using aerial reconnaissance.** Wade, J.E. (Oregon State Univ., Corvallis); Baker, R.W.; Maule, P.A.; Butler, N. *Wind Engineering ;* **5**: No. 2, 108-114(1981).

This paper describes the results of recent work using aerial reconnaissance for rapidly identifying locations with good wind power potential. Aerial surveys employing a jet ranger helicopter were used to spot wind-deformed trees in the Columbia River Gorge and in northeastern Washington. About 8500 $Km^2$ were covered in the two one-day aerial surveys. Six good locations were noted in the Columbia River Gorge and three good locations in northeast Washington based on trees strongly deformed by wind. Three of the good locations in the Columbia River Gorge have wind data that verifies the wind power potential. The results of these aerial surveys are encouraging and indicate that at least in areas with trees reconnaissance level observations can effectively screen large areas quickly. Preliminary evaluation of other important criteria of good wind sites (i.e. land area, accessibility, proximity to power lines, and possible land use conflicts) can also be conveniently noted during the aerial survey.

## 1704 Economics

33238 **Integration of wind power into Australian electricity grids without storage: a computer simulation.** Diesendorf, M. (CSIRO, Canberra, Australia); Martin, B. *Wind Engineering ;* **4**: No. 4, 211-226(1980).

A computer simulation is performed of the opration of two fuel-based Australian State electricity grids (WA and SA) with zero storage and added hypothetical wind power capacity. It is found that wind energy contributions of 20 percent (WA) and 30 percent (SA) of the annual grid energy output can be achieved before the losses of unutilized wind energy increase to 20 percent of wind energy generation. The results are sensitive to the extent to which the output of conventional units can be regulated or cycled. Small modifications to the grid operating strategy can affect the extent to which wind energy substitutes for a mixture of peak, intermediate and base load fuel or mainly for base load fuel. The most economical operation strategy is not necessarily the one which places wind at the top of the merit order.

## 1705 Environmental Aspects

33239 **Review of the icing problem for aerogenerators.** Mortimer, A.R. (Science Research Council, Chilton, England). *Wind Engineering ;* **4**: No. 4, 183-191(1980).

This paper reviews factors that create icing and methods of combatting the problem. Considerable research has been done in meeting the problems posed by the need to operate aircraft in all weathers, and much expertise in the subject is now available. The conditions under which aerogenerators work are similar in part to those of helicopters but not of the same magnitude. A detailed investigation is required to establish whether a problem exists in general and at selected locations, and if so to assess its magnitude. Since to shut down an aerogenerator during icing conditions is nonproductive, it is necessary to consider carefully the problems and penalties associated with adopting an anti-icing system. Some areas of interest for the universities are listed.

## 1706 Wind Energy Engineering

*REFER ALSO TO CITATION(S) 33090, 33235, 33237, 33239*

33240 **(DOE/DP/00789—T15) Wind ripple analysis.** Akins, R.E. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 8p. NTIS, PC A02/MF A01. Order Number DE81030129.

Efficient and economical utilization of wind power will require the ability to measure and ultimately predict the effects fluctuations in the incident wind will have on a wind turbine. In order to quantitatively assess these effects, experimental techniques have been developed which allow analysis of full-scale performance of wind turbines with particular emphasis on the effects caused by turbulence in the incident wind. Examples of these techniques are presented using data from the DOE/Sandia Vertical Axis Wind Turbine (VAWT) program.

33241 **(DOE/NASA/3303—1) General review of the MOSTAS computer code for wind turbines.** Dugundji, J.; Wendell, J.H. (Massachusetts Inst. of Tech., Cambridge (USA). Aeroelastic and Structures Research Lab.). Jun 1981. Contract AI01-76ET20320. 74p. (NASA/CR—165385). NTIS, PC A04/MF A01. Order Number DE81030416.

The MOSTAS computer code for wind turbine analysis is reviewed, and the techniques and methods used in its analyses are described in some detail. Some impressions of its strengths and weaknesses, and some recommendations for its application, modification, and further development are made. Additionally, some basic techniques used in wind turbine stability and response analyses for systems with constant and periodic coefficients are reviewed in the Appendices.

33242 **(DOE/R5/10226—1) Project demonstration of wind-turbine electricity: interconnecting a northern Michigan fruit farm with a major utility.** Amon, D.M. (Amon Cherrywood Farms, Williamsburg, MI (USA)). 1981. Contract FG02-80R510226. 86p. NTIS, PC A05/MF A01. Order Number DE81030950.

The purpose of this proposed energy related project is to test the economic feasibility of wind turbine technology for generating electricity as it relates to: (1) use of wind generated electricity on a commercial fruit farm; (2) interconnecting a commercial fruit farm with a major utility, Cherryland Rural Electric Cooperative Association (CRECA), to sell power. Progress on the project is reviewed.

33243 **(PNL-SA—9411) Analysis of data from the US Department of Energy's meteorological validation program.** Sandusky, W.F.; Buck, J.W. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1981. Contract AC06-76RL01830. 19p. NTIS, PC A02/MF A01. Order Number DE81030100.

This paper provides a brief history of the Meteorological Validation Program (MVP) and describes unique features of the summarized data for 16 of the initial 17 candidate sites. Information is provided on available wind power for each site and the projected power for a MOD-2 turbine at each site. The available wind power data are compared to data from the Resource Assessment Program conducted by DOE to locate areas of high wind energy potential in the contiguous United States, Alaska and Puerto Rico. Also included is the effect of data recording techniques and averaging period of the data on Weibull distribution parameters. In addition, the paper briefly discusses the selection of 20 additional candidate sites and the direction the program will take in the future.

33244 **Comparative study of wind characteristics from different time periods.** Goh, T.N.; Nathan, G.K. (Univ. of Singapore). *Wind Engineering ;* **5**: No. 2, 60-65(1981).

The consistency of wind characteristics at a given station is studied through mathematical modelling of wind data from two different years measured at this station and at a control station. Possible changes in wind speed dynamics are then inferred from model changes.

33245 **Wind tunnel tests of sailwings for Darrieus rotors.** Revell, P.S.; Everitt, K.W. (Univ. of Warwick, Coventry, England). *Wind Engineering ;* **5**: No. 2, 73-90(1981).

Wind tunnel tests have been made to investigate the aerodynamics of sailwings intended for use in vertical axis wind turbines. The tests were made over the full range of angles of incidence and used a number of different membranes and pre-tensions. The majority of tests used a rigid trailing edge but a limited number of tests was made using a wire or nylon cord in a circular-arc shaped trailing-edge. The tangential and radial force coefficients were measured as also was the chordwise component of membrane tension. It is concluded that such turbines should produce a high starting torque and that their performance will be influenced by the trailing edge elasticity and pre-tension at quite low tip speed ratios.

33246 **Simple model for the probability distribution of wind power with applications to large scale electricity generation.** Hastlett, J. (Trinity Coll., Dublin, Ireland); Carlin, J. *Wind Engineering ;* **5**: No. 2, 115-132(1981).

A simple model for the distribution of wind power W from one or more sites is presented. The parameters of the model may be estimated from data on wind power obtained from analyses of records of wind speed, or more usefully (and particularly so in the early stages of a wind power resource evaluation project) from a model of the distribution of wind speeds. It is shown how the model may be used together with data on the distribution of L, the load or demand for electricity, to compute the distribution of L-W, the residual load placed on conventional plant when wind power W is introduced into a grid. Examples are given of applications of the model.

33247 **Wind turbine.** Kadlec, E. (Sandia Lab, Albuquerque, NM). *CHEMTECH ;* **10**: No. 5, 324-326(May 1980).

Sandia Laboratories is conducting research into the vertical axis wind turbine (VAWT) as an energy source. Detailed computer modeling and analysis, along with design and operation of prototype turbines, are conducted to establish mechanical practicality. Other research is aimed at defining potential applications, economics, and best geographic locations for VAWT systems. The new 17-m turbine recently erected is currently the largest of its type in the United States. In a three-blade configuration, this turbine will produce approximately 60 kW of electricity.

**33248 Flow curvature effects on darrieus turbine blade aerodynamics.** Migliore, P.G.; Wolfe, W.P.; Fanucci, J.B. (WVa Univ, Morgantown). *Journal of Energy ;* **4**: No. 2, 49-55(Mar-Apr 1980).

The effects of curvilinear flow on Darrieus turbine blade aerodynamics are described. Analysis shows that these effects can have a sizeable impact on performance for blades of large chord. Experimental data are presented which verify this forecast. Unusually large boundary-layer radial pressure gradients and virtually altered camber and incidence are identified as causal phenomena. Conformal mapping techniques are used to transform geometric airfoils in curved flow to their virtual equivalents in rectilinear flow. it is argued that flow curvature is an important determinant of Darrieus turbine blade aerodynamic efficiency and that its proper consideration will yield performance improvements, even for blades of small chord. 6 refs.

**33249 Performance analysis for horizontal axis wind turbines applicable to variable pitch or airbrake control.** Lewis, R.I.; Cheng, K.Y. (Univ. of Newcastle Upon Tyne, England). *Wind Engineering ;* **4**: No. 4, 192-210(1980).

A theoretical analysis is developed for predicting the performance of horizontal axis wind turbines of prescribed geometry and of known profile aerodynamics. The solution is based upon the matching of axial thrust according to momentum control volume analysis to that corresponding to the aerodynamic blade forces, and unlike most theories allows for the division of stagnation pressure loss in the wake between shaft power and frictional losses. The theory also predicts the influence of air brakes upon the system characteristic, and makes it possible to compute characteristics with variable pitch control applied to the whole blade or parts of it. A design method is also presented for selection of blade geometry to suit prescribed radial distribution of blade loading.

**33250 Estimation of the parameters of the distribution of wind speed and direction.** McWilliams, B.; Sprevak, D. (Queen's Univ., Belfast, Ireland). *Wind Engineering ;* **4**: No. 4, 227-237(1980).

Statistical properties of the joint distribution of wind speed and direction are presented and used in an improved and simplified method of estimation of the parameters of the distribution. The proposed estimation procedure is tested against wind data from all available sites in Ireland. The agreement obtained between theory and observations gives further evidence to support the suitability of the theoretical model and the estimation procedure for the distribution of wind speed and direction.

**33251 Simulation of a wind-powered water heater.** Galanis, N.; Remboutsicas, D. (Sherbrooke Univ., Quebec). *Wind Engineering ;* **4**: No. 4, 247-254(1980).

A model is proposed for simulating the dynamic thermal behavior of wind water heaters, consisting of a wind generator, a sensible heat storage reservoir, an auxiliary heater and appropriate periodic representations of the domestic hot water consumption and of the replacement water temperature. Its use is illustrated by an evaluation of the annual performance of such a system for two different wind regimes.

# 20 ELECTRIC POWER ENGINEERING

*REFER ALSO TO CITATION(S) 33399*

## 2001 Power Plants And Power Generation

*REFER ALSO TO CITATION(S) 32895, 32895, 32934, 32935, 32943, 32952, 33088, 33269, 33322, 33334, 33423, 33424, 33425, 33426, 33435, 33573*

**33252 (ANL/FE—81-55) Assessment of coal-using, combined-cycle, heat-engine options for residential/commercial total and integrated energy systems.** Jain, M.L. (Argonne National Lab., IL (USA)). Sep 1980. Contract W-31-109-ENG-38. 62p. NTIS, PC A04/MF A01. Order Number DE81030092.

Two-gas-steam turbine, combined-cycle engine concepts that use coal are considered for application in residential/commercial total energy systems. The first concept, the pressurized fluidized-bed, combined-cycle (PFBCC) system, is based on direct combustion of coal for production of electric power and heat. The second concept, the integrated gasifier, combined-cycle (IGCC) system, involves conversion of coal into low- or medium-Btu gas and then combustion of this clean fuel to produce power and heat. For a large community with a 48% residential and 52% commercial mix, the analysis shows that: (1) up to 35% energy could be saved by using a PFBCC-based total energy system; (2) up to 32% energy could be saved by using an IGCC-based total energy system; (3) compared to a conventional energy system, both concepts could significantly reduce air pollution because of lower fuel consumption and favorable emission characteristics; and (4) because of high capital costs for these heat-engine concepts, rates of return on investment (ROI) based on CTAS and DRI escalators do not appear to be attractive at this time. The rates of return on investment based on CTAS escalators are only 7.4% for the PFBCC-based system and 6.2% for the IGCC-based system. Furthermore, using DRI price escalators, the ROI is only 0.5% for the PFBCC-based system, and the cost exceeds the benefit for the IGCC-based system. Thus, based on currently projected high capital costs for the combined-cycle-engine-based total energy systems, it does not appear likely that these technologies could be economically viable in unit sizes of 5 to 15 MW for total energy applications.

**33253 (CONF-810946—1) US ceramic heat exchanger technology: status and opportunities.** Tennery, V.J. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE81029686.

From Conference on advancement in heat exchangers; Dubrovnik, Yugoslavia (7 Sep 1981).

The status of ceramic heat exchanger technology in the United States is reviewed including the basis for interest in designing, building, and demonstrating these components for application in energy systems. Ceramic heat exchangers for waste heat recovery and for advanced energy systems are discussed. (WHK)

**33254 (DOE/ET/11448—T1) External combustion steam injected gas turbine for cogeneration. Final report.** (Boyce Engineering International, Inc., Houston, TX (USA)). Jan 1980. Contract AC03-77ET11448. 200p. NTIS, PC A09/MF A01. Order Number DE81026133.

An externally fired steam injected gas turbine has been designed and developed. The system involves both the fuel flexibility and cogeneration concepts. The major objective of this project was to indicate the technical feasibility of the system as well as to obtain an insight to the problems associated with the system. The design, development, and testing of the external combustion steam injected gas turbine are discussed. A theoretical treatment of the gas turbine cycle is made and the advantages of externally fired steam injected cycles are given. Design details of the modifications are shown. A computer description of the heat exchanger, the gas turbine, all modifications made and the test facilities is included. Theoretical calculations and cycle analysis investigations were made to find a desirable engine for modification and to get basic information on the heat exchanger specifications. A detailed design of the heat exchanger ducting system, the steam generation system, and the other support systems was conducted, and test facilities were built. The testing phase was a total of approximately 80 h of engine test time. Several modifications were made during this phase. Several alternative start strategies were evaluated and it now seems that steam-assisted starts are the most attractive. The utility of the steam system was found to be tremendous. Even though it was originally envisioned that only 5% by mass flow would be utilized, steam now appears to be invaluable during the startup phase. Again, it has a great potential in its application as an atomizing medium for the burner. It was concluded that the technical feasibility of the external combustion steam injection concept has been indicated as the unit was made to self sustain. Some further modifications are required to ensure higher power outputs and faster startups.

**33255 (EPRI-AP—1422-Vol.2) Entrained gasification combined-cycle control study. Volume 2. Results. Final report.** Clark, J.; Denton, L.; Hashemi, M.; Joiner, J.; Smelser, S.; Chowaniec, C.; Hobbs, M.; Jennings, S.; Phelts, E. (Fluor Engineers and Constructors, Inc., Irvine, CA (USA); Westinghouse Electric Corp., Concordville, PA (USA)). Jul 1980. 495p. NTIS, PC A21/MF A01. Order Number DE82900084.

Two control strategies were evaluated for a new type of electric power plant as part of a large utility network. An entrained coal gasifier fuels a gas turbine/steam turbine combined-cycle unit forming the integrated plant which was simulated by computer to analyze alternative control strategies. Transient operation of this gasification-combined-cycle (GCC) plant was studied to determine open-loop response as a stand-alone plant, as well as closed-loop response while functioning in a typical utility power system. GCC plant performance during specified operating contingencies, such as equipment trip or emergency shutdown, was also studied. Features of the GCC plant as simulated include a single-stage entrained (Texaco) gasifier fed concurrently with a coal-water slurry and gaseous oxygen, a cold gas cleanup train with a physical absorption (Selexol) system for selective sulfur removal, and advanced gas turbine design gased upon 2400°F combustor outlet temperature. Conclusions are as follows: The GCC plant may be controlled satisfactorily in either gasifier-lead or turbine-lead control mode. The absorber column consistently removed 90% $H_2S$ in the raw fuel gas from high sulfur Illinois coal. GCC plant pressure control must be installed to minimize plant pressure transients at the absorber column. The local controllers adequately maintained the GCC plant operation during all the emergency upsets. The GCC plant responds well to typical variations in electric power demand. Supplemental fuel gas storage is not required. Oxygen plant can affect the response time of the GCC plant. Response rates of 3%/min at the oxygen plant would make the GCC plant very responsive to electrical load changes.

**33256 (EPRI-AP—1422-Vol.3) Entrained gasification combined-cycle control study. Volume 3: model descriptions. Final report.** Clark, J.; Denton, L.; Hashemi, M.; Joiner, J.; Smelser, S.; Chowaniec, C.; Hobbs, M.; Jennings, S.; Phelts, E. (Fluor Engineers and Constructors, Inc., Irvine, CA (USA); Westinghouse Electric Corp., Concordville, PA (USA)). Jul 1980. 133p. NTIS, PC A07/MF A01. Order Number DE82900247.

Two control strategies were evaluated for a new type of electric power plant as part of a large utility network. An entrained coal gasifier fuels a gas turbine/steam turbine combined-cycle unit forming the integrated plant which was simulated by computer to analyze alternative control strategies. Transient operation of this gasification-combined-cycle (GCC) plant was studied to determine open-loop response as a stand-alone plant, as well as closed-loop response while functioning in a typical utility power system. GCC plant performance during specified operating contingencies, such as equipment trip or emergency shutdown, was also studied. This volume presents the model descriptions for the Texaco entrained gasifiers, Selexol unit, oxygen plant, scrubber, ammonia absorber, water balance, combustion turbine-generator and gas-turbine controls, heat recovery steam generators, steam turbine-generator and steam-turbine controls, fuel gas expander, power system, and station controller.

**33257 (EPRI-AP—1889(Vol.1)) Water-cooled gas turbine development program. Final report.** (General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). Jun 1981. 249p. NTIS, PC A11/MF A01. Order Number DE81904245.

This is the final report of the EPRI Water-Cooled Gas Turbine Development Program, RP234. The program was initiated in 1974 to establish the viability of water-cooling as a means of achieving higher firing temperatures and increased fuels flexibility in utility gas turbines. The initial phase of this program established that water-cooling was indeed a viable concept and that it could result in considerable improvements in gas turbine combined-cycle efficiency at increased firing temperatures. The initial phase of the program also identified several areas of turbine design that required further information and detailed data before the design and fabrication of a complete gas turbine could proceed. These areas included: water heat transfer in rotating buckets; transfer of cooling water to the turbine rotor; distribution of the water to individual cooling passages in the buckets; collection of unvaporized water from the bucket tips; the influence of water on rotor and bucket vibration; water purity requirements to limit deposition in cooling passages; water erosion of turbine materials; and the establishment of proper blading surface temperatures to minimize hot corrosion and ash deposition from contaminated fuels. The results of the work accomplished in the above areas, as well as other technology, are reported herein. Volume 1 of this final report summarizes the RP234 work as it relates to the design and application of a water-cooled gas turbine. Volume 2 of this final report documents in detail the work as accomplished in the individual program tasks. Detailed Topical Reports containing the work accomplished in the individual tasks are also available. Volume 2 collects these Topical Reports and contains detailed descriptions of the test rigs, experimental procedures and data acquired during the testing.

**33258 (EPRI-AP—1889-Vol.2) Water-cooled gas turbine development program. Final report.** (General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). Jul 1981. 651p. NTIS, PC A99/MF A01. Order Number DE81904229.

This is the final report of EPRI Water-Cooled Gas Turbine Development Program, RP234. The program was initiated in 1974 to establish the viability of water cooling as a means of achieving higher firing temperatures and increased fuels flexibility in utility gas turbines. The initial phase of this program established that water cooling was indeed a viable concept and that it could result in considerable improvements in gas turbine combined-cycle efficiency at increased firing temperatures. The initial phase of the program also identified several areas of turbine design that required further information and detailed data before the design and fabrication of a complete gas turbine could proceed. These areas included: water heat transfer in rotating buckets; transfer of cooling water to the turbine rotor; distribution of the water to individual cooling passages in the buckets; collection of unvaporized water from the bucket tips; the influence of water on rotor and bucket vibration; water purity requirements to limit deposition in cooling passages; water erosion of turbine materials; and the establishment of proper blading surface temperatures to minimize hot corrosion and ash deposition from contaminated fuels. The results of the work accomplished in the above areas, as well as other technology, are reported herein. Volume 1 of this final report summarizes the RP234 work as it relates to the design and application of a water-cooled gas turbine. Volume 2 of this final report documents in detail the work as accomplished in the individual program tasks. Detailed Topical Reports containing the work accomplished in the individual tasks are also available. Volume 2 collects these Topical Reports and contains detailed descriptions of the test rigs, experimental procedures, and data acquired during the testing.

**33259 (EPRI-AP—1933) Advanced cooling full-scale engine demonstration program. Final report.** (Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Systems Div.). Jul 1981. 240p. NTIS, PC A11/MF A01. Order Number DE81904240.

The objective of the Advanced Cooling Full Scale Engine Demonstration Program is to develop and demonstrate an advanced cooling technology for vanes, blades and associated hot section components of a combustion turbine. This technology will improve the reliability and fuel flexibility of combustion turbines at current turbine burner outlet temperatures and provide growth potential to 2300°F. In the Phase I program, three advanced cooling concepts were investigated for application over a maximum metal temperature range of 1100 to 1500°F: Lamilloy Spar, Shell/Spar and Hybrid. A deposition test was conducted to determine the susceptibility of transpiration cooled vanes to plugging in a residual oil combustion environment. A demonstration verified the ability to fabricate advanced cooling components required for full scale engine hardware. The engine modifications required to incorporate this hardware were defined. The Shell/Spar concept at 1500°F maximum metal temperature was selected for detailed design and fabrication in Phase II. This selection was based on the extra insurance against transpiration hole plugging that the Shell/Spar concept provides; temperature selection is based on performance and

corrosion considerations. A design criteria for fabricating the Shell/Spar blades and vanes has been developed to initiate the Phase II program.

**33260 (EPRI-AP—1943) Combustion turbine combined-cycle R and D project priority analysis. Final report.** Deligiannis, K.S.; Patmore, J. (Encotech, Inc., Schenectady, NY (USA); Systems Control, Inc., Palo Alto, CA (USA)). Jul 1981. 237p. NTIS, PC A11/MF A01. Order Number DE81904206.

The development of reliable and cost effective combustion turbine combined cycle systems requires definition and funding of supporting R and D projects. Since time and funds to meet this development goal are limited, a method to prioritize potential R and D projects is highly desirable. The purpose of this study was to develop a computerized prioritization methodology for Combustion Turbine R and D projects. The methodology includes a Combined-Cycle Plant Simulation Model (CCPSM) and a prioritization algorithm that ranks alternatives based on their benefit/cost effectiveness.

**33261 (EPRI-CS—1838) Magma cooling-tower process pilot-plant demonstration. Final report.** Sanderson, W.G. (Tower Systems, Inc., Tacoma, WA (USA)). May 1981. 159p. NTIS, PC A08/MF A01. Order Number DE81903783.

The Magma Cooling Tower (MCT) is a new process which offers a low energy approach for evaporation and concentration of waste water. A three month test program of the MCT portable pilot plant was conducted at the Sunrise Station of Nevada Power Company for the purpose of demonstrating this new technology. The MCT contains vertically oriented water-water-air falling film heat exchangers which are configured for indirect cooling of a primary fluid through evaporation of a secondary fluid into an air stream. The secondary fluid is contained in a circulating loop within the MCT and is composed of treated plant waste water. The secondary fluid is exposed primarily to low temperature non-metallic surfaces and can be maintained at very high dissolved solids levels. The principal objective of the program was to demonstrate the capability of the MCT to evaporate and concentrate waste water blowdown using low quality waste energy from the cooling water loop. A second objective was to demonstrate the control of scaling, fouling and corrosion in the high solids brine environment of the MCT secondary loop. Two modes of scale control were tested during the program. The first mode was based on chemical softening of makeup water to the secondary loop and was preferred for the NPC application. The second mode was baed on controlled crystallization of scale forming agents within the secondary circulating loop. The Magma Cooling pilot plant test was successful; and evaporation, scale control, and waste concentration were demonstrated. Results were within the limits predicted prior to the test. It was concluded that the Magma Cooling Tower is a viable mature technology which should be considered along with other water management techniques available to the industry.

**33262 (EPRI-CS—1938) Vibration signature analysis and acoustic-emmission monitoring at Brayton Point. Final report.** Pekrul, P.J.; Pennise, S. (Rockwell International Corp., Canoga Park, CA (USA)). Jul 1981. 268p. NTIS, PC A12/MF A01. Order Number DE81904232.

This report discusses the on-line monitoring techniques of vibration signature analysis and acoustic emission detection in light of a two-year monitoring program at the Brayton Point plant of New England Power Service Company. Included in the study are discussions relating to sensor selection and location, spectrum analysis techniques, computation equipment, and display devices. Specific plant equipment failures occurred during the monitoring period, and the appropriate vibration and acoustic emission data are analyzed to assess any deviations prior to failure. Vibration signature analysis is seen to be a well-developed technique which can be successfully implemented into a preventative maintenance system for fossil plants. Before being able to detect changes in vibration spectra due to malfunction, however, it is stressed that a full understanding of the effect of normal variations in plant parameters (load, speed, etc.) should be achieved. This implies a statistical base of information and derived correlation equations. Acoustic emissions may have application for detection of material failure, such as shaft cracking, and for detection of tube leaks from heat exchangers. These tests, however, were inconclusive and suggest that considerable characterization data are required before acoustic emissions can be successfully implemented as a diagnostic technique.

**33263 (EPRI-EM—230) Sodium chloride battery development program for load leveling. Interim report, January 1, 1975-December 31, 1975.** (ESB, Inc., Yardley, PA (USA). ESB Technology Center). Dec 1975. 91p. NTIS, PC A05/MF A01. Order Number DE82900234.

Work performed between January 1 - December 31, 1975 toward the development of a molten sodium chloride battery for load leveling is reported. A cell has been developed which offers considerable promise for lightweight, long life, and low cost batteries. It includes a steel-contained molten sodium negative, a separator conductive to sodium ions, a molten sodium chloroaluminate electrolyte, a molten metal chloride positive (typically, but not exclusively antimony trichloride), dispersed carbon powder, and a metallic positive current collector. The cell operates at 200°C and is thus able to use silicone rubber instead of glass to seal the molten sodium (most glasses are slowly attacked by molten sodium). The low temperature also favors a longer life for the beta alumina separator before penetration occurs and reduces current collector and seal corrosion. The vapor pressure of the cell is only a few torr. No solid-solid reactions are involved; this together with the absence of immiscible liquid phases (antimony trichloride is quite soluble in the molten electrolyte) allows the cell to be deep-cycled without damage or degradation. The open circuit voltage at full charge is slightly above 3 volts. The ionic conductivity of the melt at 200°C is about 7 ohm-cm at full charge (less at partial discharge), compared to 3 ohm-cm for molten sodium pentasulfide at 350°C and an extremely high value for molten sulfur. (WHK)

**33264 (ORNL/Sub—7399/1) Selective load control for industrial customers.** Dybeck, R.; Clark, K.; Pisula, R.; Simay, G. (Oak Ridge National Lab., TN (USA); Burbank City Public Service Dept., CA (USA)). Sep 1981. Contract W-7405-ENG-26. 331p. NTIS, PC A15/MF A01. Order Number DE81030433.

The City of Burbank Public Service Department (PSD) uses a computer-based load control system at its Dispatch Center to test selective load control (SLC) for its three largest industrial customers: Menasco, Lockheed-California Company (Lockheed), and The Burbank Studios (TBS). A separate remote meter reading system records and displays kilowatt demand and kilowatthour consumption. Under SLC the customer, with the utility's assistance, ultimately selects the loads appropriate for utility control. PSD currently controls a total of 704 kW of load, representing about 0.4% of PSD's peak demand. Based on an analysis of several years of hourly load data, PSD determined that SLC could reduce system peak demand by up to 5%, if implemented on a broader scale. SLC could be attractive to a utility if it can be applied to large industrial customers with sizeable loads available for utility control. A successful program of utility control is most likely if the utility adheres to the following guidelines: (1) the utility does not control individual customer loads but instead interfaces with the customer's own automated load shedding system; (2) together, the utility and the customer carefully select the loads appropriate for SLC; (3) the utility follows a step-by-step procedure for implementing SLC, using the energy survey as an important tool; and (4) the utility rate structure encourages customer support, giving significant credit for electrical load being available for demand reduction. Since 1977, PSD has been testing SLC under subcontract to the Union Carbide Corporation and with the support of the Department of Energy, Division of Electric Energy Systems. Efforts prior to 1977 were supported by the American Public Power Association.

**33265 (ORNL/TM—7847) Tennessee Valley Authority atmospheric fluidized-bed combustor simulation interim annual report, January 1-December 31, 1980.** Wells, J.W.; Culver, M.H.; Krishnan, R.P. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 263p. NTIS, PC A12/MF A01. Order Number DE81030262.

A detailed description of the work performed during 1980 for the Tennessee Valley Authority (TVA) in support of the TVA

Fluidized-Bed Combustion (FBC) Demonstration Plant Program is presented. The work was carried out under Task 4, modeling and simulation of atmospheric fluidized-bed combustion (AFBC) systems. The overall objective of this task is to develop a steady-state mathematical model with the capability of predicting trends in bed performance under various feed and operating conditions. Previously during 1979, three predictive subcodes (subprograms) were developed: bubble growth subcode, elutriation-attrition subcode, and coal combustion subcode. During 1980, three additional predictive subcodes were developed: the $SO_2$ capture subcode, the NO/sub x/ emissions subcode, and the freeboard subcode. Also, during this period, the following subcodes were combined to form an overall simulation code of the AFBC bed: (1) bubble growth subcode, (2) elutriation-attrition subcode, (3) coal combustion subcode, (4) $SO_2$ capture subcode, and (5) NO/sub x/ emissions subcode. In addition, an energy balance routine was added to the combined code. The resulting overall bed simulation, which is currently being tested with experimental data, is capable of predicting how some of the important operating variables affect AFBC's performance. The freeboard model has been combined with the overall bed simulation and is currently being debugged. Once the overall AFBC simulation is operational, it will be tested against field data from operating AFBCs and used to simulate the TVA/Electric Power Research Institute (EPRI) 20-MW(e) AFBC pilot plant. (WHK)

33266 **(RD/M/N—1131) Interfacial structures in nickel-based transition joints after long term service.** Nicholson, R.D. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.). Sep 1980. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE81903971.

Three transition 2 1/2 Cr-1 Mo/316 ss) joints from Ratcliffe Power Station have been examined after service of between 57,087 and 65,396 hours at temperatures of 570 to 605°C. Specimens have been examined using microhardness, optical and scanning electron microscopy, SEM. Variations in chemical composition across the joints were determined using the EDAX attachment on the SEM. For detailed examination of the ferritic/weld metal interface, carbon extraction replicas have been examined in the transmission electron microscope and selected area electron diffraction and EDAX analysis used to identify the precipitates. The effects of renormalizing for 1/2 hour at 960°C and subsequently stress relieving for 3 hours at 700°C on the interfacial structure of the joints have also been investigated. Results are compared with other published work. Factors determining the interfacial structures are discussed and a mechanism for the formation of the long-term aged structure is suggested.

33267 **New approach for erosion prediction due to fly ash.** Kotwal, R.; Tabakoff, W. (Univ of Cincinnati, Ohio). *Journal of Engineering for Power ;* **103**: No. 2, 265-270(Apr 1981).

With increasing interest in the burning of coal in industrial gas turbines, there is also concern for the precise determination of the erosive effects on the turbine components. A series of experiments were conducted to determine the effects of fly ash constituents, particle size, particle velocity, angle of attack and target temperature on the erosion of iron and nickel base alloys. Based on the experimental results, a semi-empirical equation has been obtained for the prediction of the erosion losses. This equation provides a new technique for predicting the metal erosion due to the fly ash produced by the conventional burning of coal.

33268 **First-principle dynamic modeling of an MHD-steam coupled power plant.** Goldsworthy, D.L.; Rudberg, D.A.; Pierre, D.A. (Mont State Univ, Bozeman). pp 6.1-6.17 of Fourth power plant dynamics, control and testing symposium. Knoxville, TN; University of Tennessee (1980).

From 4. power plant dynamics, control and testing symposium; Gatlinburg, TN, USA (17 Mar 1980).

A first-principle dynamic model is developed for a coupled magnetohydrodynamic (MHD) steam electrical generating plant. Distinctive aspects of an MHD steam facility are covered, followed by discussion of conceptual design of the plant. Included are descriptions of the model's salient features and the control strategies under investigation. The manner in which the model is implemented is also described. The model has been coded, and simulation results will be discussed with the presentation of the paper. 11 refs.

## 2002 Environmental Aspects

*REFER ALSO TO CITATION(S) 32862, 32870, 32871, 32878, 32879, 32895, 32946, 32989, 33722, 33723, 33725, 33744, 33759, 33769, 33770, 33794*

33269 **(ANL/CEN/FE—81-1) Studies of the regeneration of activated bauxite used as granular sorbent for the control of alkali vapors from hot flue gas of coal combustion.** Lee, S.H.D.; Smith, S.D.; Swift, W.M.; Johnson, I. (Argonne National Lab., IL (USA)). May 1981. Contract W-31-109-ENG-38. 51p. NTIS, PC A04/MF A01. Order Number DE81030192.

Regeneration of activated bauxite was studied by water-leaching and thermal swing (high-temperature desorption) methods. Granular activated bauxite has been identified to be very effective when used as a filter medium (i.e., sorbent) in granular-bed filters to remove gaseous alkali metal compounds from simulated hot flue gas of PFBC. Activated bauxite that had captured alkali chloride vapors was demonstrated to be easily and effectively regenerated for reuse by a simple water-leaching method. Data were obtained on (1) the leaching rate of the adsorbed NaCl, (2) effects on the leaching rate of adsorbed NaCl loading, leaching temperature, and the amount of water, and (3) water retention in activated bauxite after leaching. Observed physical changes and particle attrition of activated bauxite as a result of regeneration are discussed. The sorption mechanisms of activated bauxite toward alkali chloride vapors are interpreted on the basis of (1) the chemical compositions of the leachates from alkali chloride-sorbed activated bauxite and (2) the desorption of adsorbed NaCl vapor from activated bauxite at high temperature.

33270 **(EPRI-FP—207) Evaluation of dry alkalis for removing sulfur dioxide from boiler flue gases. Final report.** (Bechtel Corp., San Francisco, CA (USA)). Oct 1976. 164p. NTIS, PC A08/MF A01. Order Number DE82900023.

This report involves a review and evaluation by Bechtel of the Wheelabrator and Superior documents on their investigations of particulate and dry scrubbing processes by injection of alkali powder, particularly nahcolite, into the furnace or the boiler flue gases. Also included is a review of the earlier work at the Mercer Station of the Public Service Electric and Gas Company of New Jersey. The principal points covered in the evaluation are the chemistry, mining, transportation, waste disposal, and economics of the several processes reviewed. Data reflecting the influence of nahcolite and other dry alkalis upon the reduction of NO/sub x/ emissions is also included. Finally, a recommendation is made as to what additional bench-scale and prototype investigations now need to be conducted to fully demonstrate the technology. Results of the various tests suggest that fabric filters injected with nahcolite appear to be the most promising method of $SO_2$ removal in the dry state. It is significant to note that the tests conducted by Wheelabrator-Frye demonstrated that commercially available fabric filters can achieve $SO_2$ removal of 69% at a 56% reagent utilization even without optimization of equipment design for reagent distribution. Although the countercurrent reactor has good potential for high removal and high utilization, the price paid for this advantage is the high pressure drop across the bed. There is also considerable uncertainty with regard to mechanical complexity of large commercial units. Furnace injection of nahcolite has been tried by Superior with a pilot plant oil-fired burner. $SO_2$ removal and reagent utilization were high. The process would require further study with coal-fired boilers. The spent material, which contains sulfate, carbonate and possibly nitrate, is water soluble and cannot be used for landfill, at least without further treatment. Several disposal possibilities have been considered, but more research is required.

33271 **(MIT-EL—80-033) Design and implementation of a demonstration supplementary control system.** Ruane, M.; Gruhl, J.; Schweppe, F.; Green, B.; Egan, B. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Dec 1976. Contract AS02-76EV02428. 253p. NTIS, PC A12/MF A01. Order Number DE81030519.

The goal of the Chestnut Ridge (Supplementary Control System (SCS) Demonstration Project is to demonstrate how an existing monitoring network, existing air quality models, and existing meteorological forecasting methods can be combined with a control strategy to integrate SCS into electric power system operation. The operation of the SCS is intended to provide field information about air quality, reliability, and economics so that the following technical objectives can be satisfied: (1) to demonstrate that an extensive, sophisticated, real-time monitoring system can be operated at a level of data capture and measurement accuracy sufficient for the needs of an SCS; (2) to demonstrate that air quality can be forecast accurately enough and far enough in advance to be useful in an SCS; (3) to demonstrate that a utility suitably prepared in advance can, in fact, switch fuel, increase stack temperature, and/or shift load while under an SCS so that ambient air quality standards in the vicinity are not violated; (4) to demonstrate that the Control Decision Logic can protect air quality standards while meeting various criteria such as cost and reliability of power system operation; (5) to demonstrate that in the presence of uncertainties in monitoring data, forecasts of air quality, emissions and response time, an acceptable reliability can be proven for the operation of an SCS; (6) to establish that a method can be developed to provide sufficient information to the appropriate regulatory agencies so they can ensure satisfactory SCS performance; and (7) to define the steps required to transfer SCS technology to other sites and plants. Progress is reported. (WHK)

33272 **Economics and control technology for NOx and particulate emissions from coal-fired power plants.** Ziegler, E.N.; Meyers, R.E. (Polytechnic Inst of New York/US Brookhaven Natl Lab, NY). *Resource Management and Optimization ;* **1**: No. 2, 181-196(Aug 1980).

Removal efficiencies and economics of various techniques to control particulates and nitrogen oxide emissions associated with coal combustion are examined. More than 95% of coal-fired power plants in the U.S. utilize electrostatic precipitation to control particulate matter. NOx emissions are most often controlled by combustion modification. Other commonly used control technologies are fabric filters and fluidized-bed combustion. Capital and operating costs of various control alternatives are comparatively evaluated.

33273 **What baghouse is best for your industrial boiler: reverse air or pulse jet.** Berst, A.H. Birmingham, Alabama; Zurn Industries (1981). 33p. (CONF-8104107—2).

From 12. annual Kentucky industrial coal conference; Lexington, KY, USA (29 Apr 1981).

In summary, the pulse jet has great advantage for side stream application and the smaller boiler sizes. For larger systems the reverse air baghouse should be used. Whatever system is selected, the customer should look carefully at the details of construction and the baghouse manufacturer's experience. The customer should also consider the type of coal to be burned and the possibility of change in coal because of its effect on the baghouse pressure drop. There is a marked difference between Western and Eastern coal fly ash. The Western coal will usually cause a higher pressure drop.

33274 **Summary report of the ABMA test program to update emissions and efficiency performance of industrial stoker-fired boilers.** Precious, R.W. Lexington, Kentucky; University of Kentucky (1981). 10p. (CONF-8104107—7).

From 12. annual Kentucky industrial coal conference; Lexington, KY, USA (29 Apr 1981).

The objective of this paper is to review the test program conducted by the American Boiler Manufacturers Association (ABMA) on industrial stoker fired boilers. It was felt that a lack of realistic emission standards was preventing the purchase and installation of stoker fired boilers in industrial plants. Tests were undertaken in 1977 and completed in 1980. The data are now available to assist consulting engineering firms and users in preparing specifications for coal-burning, stoker-fired boilers. An additional feature of these tests will be an operations manual outlining techniques for burning a range of coals effectively and efficiently and facilitate purchasing from several different suppliers. I am confident that we can design, manufacture, install and operate a coal-fired, stoker boiler with confidence that it will meet the stack emission standards set by EPA. The data have supplied the interactive effects of the many variables associated in burning coal on a stoker under a boiler. Each application, each installation will be required to meet a different set of ground rules. We need no longer try to design in the dark, to generalize, to assume factors in specifications prepared by engineers for the purchase of stoker fired boilers. Time will determine the usefulness of this data. The manufacturer, the consulting engineers and the users will ultimately prove the value of the data. ABMA is satisfied it served industry in proposing the tests, managing the field work and directing this program. I sincerely hope the next few years will see the successful installation of many stoker-fired boilers burning more and more coal efficiently and economically to the satisfaction of more and more users.

33275 **Impact of climate and energy, and the $CO_2$ problem.** Moses, H. (US DOE, Washington, DC). *Proceedings of the Air Pollution Control Association ;* **4**: No. 80-55.1, vp(1980). (CONF-800608—).

From Air Pollution Control Association annual meeting; Montreal, Canada (Jun 1980).

The production of power impacts upon the atmosphere is discussed. The paper shows the energy consumption from 1973 through 1979 for each of technologies--oil, coal, nuclear, hydroelectric, and natural gas.

## 2003 Power Transmission And Distribution

*REFER ALSO TO CITATION(S) 33390, 33419, 33420, 33477, 33478*

33276 **(CONF-811016—2) Partial discharge inception and extinction studies in polymer film structures impregnated with compressed $SF_6$ gas.** Reed, C.W.; Atkins, J.M. (General Electric Co., Schenectady, NY (USA). Research and Development Center). 1981. Contract AC01-77ET29069. 16p. NTIS, PC A02/MF A01. Order Number DE81029140.

From Conference on electrical insulation and dielectric phenomena; Whitehaven, PA, USA (25 Oct 1981).

New concepts for a gas insulated transformer include the following turn-to-turn structure for the transformer windings: sheet conductor (aluminum foil); polymer film insulation (Mylar film); and pressurized $SF_6$ gas (impregnating the structure). A previous study of this structure compared the 60 Hz discharge inception and breakdown performance of model windings using 0.0125 and 0.0233 mm thick polymer films. The present experimental investigation is part of a larger program evaluating the effect of different parameters (gas pressure, voltage waveform, conditioning effects, etc.) on the performance of this insulation system. Six-inch size models, featuring multiple samples wound concentrically, were tested. A new winding apparatus was designed and built specifically for the construction of these models. The test equipment, procedures, and results are discussed. The results showed that good consistency was achieved in the discharge and breakdown performance of 6-in. size coils wound on the specially-designed winding apparatus; normal probability plots indicate a single mode of breakdowns, partly determined by the quality of the conductor edge finish and partly by chance residual particles; the validity of using multiple-sample test coils was demonstrated; there has been no evidence for conditioning effects on discharge behavior in tests in air or $SF_6$ gas using coils constructed with precision slit aluminum; and discharge inception and extinction are affected by gas pressure in short-time tests, but breakdown is unaffected.

33277 **(DOE/ET/29335—T1) Acoustic waveguide technique for sensing incipient faults in underground power-transmission cables: including acousto-optic techniques. Final report.** Harrold, R.T. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Sep 1981. Contract AC01-78ET29335. 66p. NTIS, PC A04/MF A01. Order Number DE81029626.

The feasibility of using acoustic waveguide techniques for sensing incipient faults in underground power transmission cables was determined. Theoretical and practical studies were made of both the acoustic emission spectrum signatures associated with cable incipient faults, and the attenuation of acoustic waves in waterfilled metal tubes used as waveguides. Based on critical data, it can be estimated that in favorable circumstances, the acoustic waveguide system would only be useful for sensing incipient faults in underground cables of ~ 800 meters (~ 0.5 miles) or less in length.

As underground power transmission cables are often several kilometers in length, it was clear at this stage of the study, that simple acoustic waveguide sensing techniques would not be adequate, and some modification would be needed. With DOE approval it was decided to investigate acousto-optic sensing techniques in order to extend the detection range. In particular, a system in which acoustic emissions from cable incipient faults impinge on a fiber-optic lightguide and locally change its refractive indes, and as a consequence, modulate laser light transmitted along the light guide. Experiments based on this concept were successful, and it has been demonstrated that it is possible to sense acoustic emissions with energy levels below one micro-joule. A practical test of this system in the laboratory using a section of compressed gas-insulated cable with an internal flashover was successfully carried out. Long distance fault sensing with this technique should be feasible as laser light can be transmitted several kilometers in fiber optic lightguides. It is believed that laser-acousto-optic fault sensing is a viable technique which, with development, could be applied for fault sensing in power cables and other apparatus.

33278 **(EPRI-EL—1946) Conductor fatigue-life research. Final report.** Ramey, G.E. (Auburn Univ., AL (USA). Engineering Experiment Station). Jul 1981. 142p. NTIS, PC A07/MF A01. Order Number DE81904209.

This is the final report of Research Project RP 1278-1 sponsored by the Electric Power Research Institute and carried out at the Civil Engineering Department of Auburn University (Auburn, Alabama). The objective of this study was to evaluate the effects of reducing vibration amplitudes of ACSR conductors which had been minimally damaged by aeolian vibration. The aeolian vibration was simulated by mechanical means in a controlled laboratory situation and the reduction in vibration amplitudes was a simulation of the addition of amplitude limiting devices (dampers). Conductors were vibrated at high amplitudes until a predetermined number of strand breaks occurred, after which the vibration was continued at reduced amplitudes. Three different ACSB conductors were tested: 795 KCM 26/7, 795 KCM 45/7, and 397.5 KCM 26/7. These conductors were chosen to establish the effects of conductor size and stranding on the amplitude reduction tests. Two different amplitude reductions were used to establish a threshold value for a maximum reduced amplitude. Previous preliminary research by others indicated that amplitude reductions extended the working life of conductors. This research expanded the amplitude reduction values and conductor sizes and strandings tested. For each set of parameters, four duplicative tests were performed to give statistical credence to the data. The results of the investigation indicated that amplitude reductions arrested fatigue strand breakage in each case. Electric utilities can utilize the results of this EPRI project in assessing the fatigue life of minimally damaged transmisson lines and in evaluating techniques for mitigating fatigue damage.

33279 **(EPRI-EL—1949) Investigation of geomagnetically induced currents in the proposed Winnipeg-Duluth-Twin Cities 500-kV transmission line. Final report.** Kappenman, J.G.; Albertson, V.D.; Mohan, N. (Minnesota Power and Light Co., Duluth (USA); Minnesota Univ., Minneapolis (USA). Dept. of Electrical Engineering). Jul 1981. 169p. NTIS, PC A08/MF A01. Order Number DE81904233.

This study investigated the effects of geomagnetically-induced currents (GIC) on a new 749 km (466 mile) 500 kV ac transmission line from the vicinities of Winnipeg, Manitoba to Duluth, Minnesota to Minneapolis-St. Paul, Minnesota. The period of performance was from July 15, 1977 through June 15, 1980, and involved a study of the effects on the operation of the 500 kV line, equipment connected directly to the line, and effects on the power systems connected to the line. The power systems that are interconnected by the 500 kV line are Manitoba Hydro, Minnesota Power and Light Company, and Northern States Power Company. The study covers the instrumentation to measure and record geomagnetic field fluctuations, earth-surface potential, and GIC; the analytical determination of GIC throughout the system; the determination of increased transformer reactive power requirements under conditions of half-cycle saturation; interconnected power system load-flow studies in the presence of GIC; switching transients on the 500 kV line and harmonic studies of the 500 kV autotransformers in the presence of GIC; the effects of GIC on current transformers and relays; and, effects of harmonics due to GIC on high voltage dc converter station operation.

33280 **(EPRI-EL—1970(Vol.1)) Research to develop guidelines for cathodic protection of concentric neutral cables. Interim report.** Hanck, J.A.; Nekoksa, G. (Pacific Gas and Electric Co., San Ramon, CA (USA). Dept. of Engineering Research). Aug 1981. 164p. NTIS, PC A08/MF A01. Order Number DE81904195.

The objectives of this project were to determine and statistically analyze data associated with corrosion of concentric neutrals (CN) of direct buried primary cables, and develop guidelines for cathodic protection of CN for the electric utility industry. This interim report includes descriptions and results of field testing conducted at 36 bellholes excavated in California, Oklahoma, and North Carolina. It also includes details of the electrochemical, chemical, bacteriological, and sieve analyses of native soil and imported backfill samples. Up to 129 values were determined for each bellhole and stored on cards as a data bank. All values were statistically analyzed and correlated with corrosion found. The severity of corrosion correlated best with CN corrosion potentials, CN resistance measurements, coarseness of backfill, and soil resistivity. The guidelines for installation of cathodic protection on CN cables will be completed for publication in July 1981. They will be based upon the evaluation of over 100 experimental cathodic protection systems and upon laboratory testing for protection criteria with and without ac effects.

33281 **(EPRI-EL—1970(Vol.2)) Research to develop guidelines for cathodic protection of concentric neutral cables. Interim report.** Hanck, J.A.; Nekoksa, G. (Pacific Gas and Electric Co., San Ramon, CA (USA)). Aug 1981. 278p. NTIS, PC A13/MF A01. Order Number DE81904210.

The objectives of this project were to determine and statistically analyze data associated with corrosion of concentric neutrals (CN) of direct buried primary cables, and develop guidelines for cathodic protection of CN for the electric utility industry. This interim report includes descriptions and results of field testing conducted at 36 bellholes excavated in California, Oklahoma, and North Carolina. It also includes details of the electrochemical, chemical, bacteriological, and sieve analyses of native soil and imported backfill samples. Up to 129 values were determined for each bellhole and stored on cards as a data bank. All values were statistically analyzed and correlated with corrosion found. The severity of corrosion correlated best with CN corrosion potentials, CN resistance measurements, coarseness of backfill, and soil resistivity. The guidelines for installation of cathodic protection on CN cables will be completed for publication in July 1981. They will be based upon the evaluation of over 100 experimental cathodic protection systems and upon laboratory testing for protection criteria with and without ac effects. Volume 2 contains four appendixes with drawings and graphs supporting descriptions and data presented in Volume 1.

33282 **(EPRI-EL—2016) Contamination flashover of HVDC insulators. Final report.** Cheng, T.C.; Wu, C.T.; Rodriquez-Penz, A. (University of Southern California, Los Angeles (USA). Dept. of Electrical Engineering). Aug 1981. 162p. NTIS, PC A08/MF A01. Order Number DE81904213.

An integrated field and laboratory study was conducted to investigate the mechanism of flashover of contaminated insulators under HVDC conditions. The field testing rack, constructed at the Sylmar Converter Station, is directly energized by the Pacific HVDC Intertie. Salient factors identified in the field studies were reproduced under simulated conditions in the laboratory for in-depth studies. Effects of each factor were studied one at a time using a highly controllable laboratory testing procedure. Newly discovered phenomena which occur during the flashover process, such as formation of clean zones and the deleterious effect of nitrates on insulating materials, were observed. Theories were formulated to explain the mechanisms involved in these phenomena. Electrochemical properties of contaminants and their effects on flashover process were examined. The relationship between single-component salts and multi-component salts was investigated. Voltage distribution along a string of insulators was studied. New insulator designs using capacitive grading were proposed. Advantages

offered by new insulating materials were exploited. New designs showed promising results in both computer analysis and initial laboratory studies.

**33283 Application of high-speed grounding switches for single-pole reclosing on 500 kV power systems.** Hasibar, R.M.; Legate, A.C.; Brunke, J.H.; Peterson, W.G. (Bonneville Power Adm, Portland, Oreg). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems ;* **PAS-100**: No. 4, 1512-1515(Apr 1981).

Applications are studied of high speed grounding switches to 500 kV single-pole-switched lines of the BPA system. Voltages and currents that the ground switch will be required to interrupt are given for various conditions. Also, field test results on a 196 km (122 mi.), 500 kV lines are included. Paper No. 80 SM 639-5. 8 refs.

**33284 Laboratory development of +-600 kV dc pipe cable system.** Allam, E.M. Sr.; McKean, A.L. (Phelps Dodge Cable and Wire Co, Yonkers, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems ;* **PAS-100**: No. 3, 1219-1225(Mar 1981).

**33285 Impedance characteristics of large tower footings to a 100μs wide square wave of current.** Rogers, E.J. (Bonneville Power Adm, Portland, Oreg). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems ;* **PAS-100**: No. 1, 66-71(Jan 1981).

Tests were performed, using a 2500 volt pulse generator, to determine impedance variations of six tower footings on the BPA 1100 kV test line. Comparisons are made with the tower's low frequency resistance. An electrical model, made with Triax Cable, is used to confirm major inflection points of impedance variations for one tower leg grillage. Paper No. 80 SM 662-7.

**33286 Investigation of corona and field effects of ac/dc hybrid transmission lines.** Chartier, V.L.; Sarkinen, S.H.; Stearns, R.D.; Burns, A.L. (US DOE, Portland, Oreg). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems ;* **PAS-100**: No. 1, 72-80(Jan 1981).

Laboratory and analytical studies are reported that have been conducted by The Bonneville Power Administration to determine corona and electric field effects of a proposed ac/dc hybrid transmission line. The proposed hybrid line would consist of a 500 kV ac circuit operating on the same structure as a /plus or minus/ 500 kV dc circuit. Generally, the laboratory studies show that, with some modification, equations used at BPA for calculating corona phenomenon can be used for a hybrid line. The paper also describes a technique for estimating dc electric field parameters which are enhanced by the presence of ions. Paper No. 80 SM 633-8.

**33287 Formulas for predicting audible noise from overhead high voltage ac and dc lines.** Chartier, V.L.; Stearns, R.D. (Bonneville Power Adm, Vancouver, Wash). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems ;* **PAS-100**: No. 1, 121-130(Jan 1981).

Bonneville Power Administration's basic philosophy for predicting audible noise from ac and dc high voltage transmission lines is described. General formulas for predicting the A-weighted audible noise during rain for ac lines and during fair weather for dc lines which were developed from data from full-scale lines are presented. From this basic calculation, audible noise cumulative distributions, frequency spectrums, and lateral profiles can be estimated. Paper No. F80 180-0.

**33288 Measurement and modeling of Pacific ac Intertie response to random load switching.** Hauer, J.F.; Cresap, R.L. (Bonneville Power Adm, Portland, Oreg). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems ;* **PAS-100**: No. 1, 353-359(Jan 1981).

Analysis of random fluctuations in power on the Pacific ac Intertie has provided information about the influence of system operating conditions upon the effectiveness of Pacific HVDC Intertie modulation, and about dynamic behavior of the western power system generally. This technique has also been used to estimate the required size for a superconducting electromagnetic storage device which will provide backup to HVDC Modulation, and has detected a major system mode 6 months before it was first observed in a transient disturbance. Paper No. 80 SM 580-1.

# 21 NUCLEAR POWER PLANTS

*REFER ALSO TO CITATION(S) 33399, 33926*

**33289 (EPRI-NP—1969-SR) Structural Mechanics Program: progress in 1980.** Nickell, R.E.; Norris, D.M.; Tagart, S.W. Jr.; Marston, T.U. (Electric Power Research Inst., Palo Alto, CA (USA). Nuclear Power Div.). Aug 1981. 138p. NTIS, PC A07/MF A01. Order Number DE81904244.

The goal of the EPRI Structural Mechanics Program is to improve nuclear plant reliability and availability. The program is directed toward characterization of materials, evaluation and analysis of flaws, and application and technology transfer. The largest efforts are: the continuation of projects aimed at developing a statistically valid radiation embrittlement data base for evaluating the fracture toughness of irradiated pressure vessel steels and for evaluating damage annealing processes for embrittlement materials; the development of weld repair procedures for reactor pressure vessels as alternatives to the half bead repair method; the development of simplified design methodology for the prediction of crack initiation, stable crack growth, and instability of ductile material in the presence of flaws; and the development of methodology for predicting the growth and stability of stress corrosion cracks in large diameter stainless steel piping.

**33290 (ERDA—80) Findings supporting determination related to international nuclear power export activities pending preparation of a section 102(2)(C) NEPA environmental statement.** (Energy Research and Development Administration, Washington, DC (USA)). 26 Sep 1975. 609p. NTIS, PC A99/MF A01. Order Number DE81029851.

Following a description of the current nature and objectives of the US nuclear power export activities, the nature and the environmental impacts during the interim under each of the principal activities are discussed. Particular emphasis is accorded the incremental environmental effects associated with the production and transportation aspects of the uranium fuel cycle attributable to the export activities, including uranium mining, uranium hexafluoride production, enrichment and fuel fabrication. An analysis is then made of the effect that continuation of these activities would have on the ultimate findings and determinations of the full NEPA review and the extent to which policy alternatives would be foreclosed. Finally, the effect on the public interest of a moratorium on these activities and the effect of resource commitments on the eventual decision following NEPA review are discussed.

## 2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

*REFER ALSO TO CITATION(S) 33318, 33319, 33333, 33342, 33350*

**33291 (DOE/ET/34031—1) 8 x 8 fuel surveillance program: pre-irradiation characterization, Monticello fuel assembly, December 1974.** Delgado, R. Jr.; Ogawa, S.Y. (comps.). (General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). Sep 1980. Contract AC02-80ET34031. 39p. NTIS, PC A03/MF A01. Order Number DE81030753.

The two fuel assemblies are vehicles for providing specific irradiation performance data as part of the lead 8 x 8 fuel reload groups in two reactors. This report describes the pre-irradiation characterizations performed on selected fuel rods from the bundle inserted into the Monticello reactor. The eleven selected fuel rods from the bundle were measured for overall bow, overall length, and profiled for diameter (helical and axial at 0, 45, 90 and 135 degrees). The rods were also neutron radiographed and the cladding was ultrasonically tested. The assembled bundle was measured for rod-to-rod spacing, spacer-to-spacer distance, and spacer perpen-

dicularity. The fuel bundle, MTB099 (2.62% bundle average enrichment), was loaded into Northern States Power's Monticello reactor as part of a reload batch for relatively high power operation. Bundle MTB099 was inserted in Position 37-30 for Cycle 3. Cycle 3 startup was in May 1974.

33292 **(DOE/ET/34031—2) 8 x 8 fuel surveillance program at Monticello - end of Cycle 3: first post-irradiation measurements, January 1975.** Masand, A.C.; Delgado, R. Jr.; Ikemoto, R.N. (General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). Sep 1980. Contract AC02-80ET34031. 41p. NTIS, PC A03/MF A01. Order Number DE81030747.

A fuel surveillance program for the lead 8 x 8 fuel assembly was implemented at the Monticello Nuclear Power Station in May 1974. The results of the first post-irradiation inspection performed on fuel assembly MTB099 in January 1975, after an average brunup of 3900 MWd/MT, are presented. The observations made and methods used to perform the various measurements to ensure bundle mechanical integrity are described. Pre- and post-irradiation measurement comparisons are made for the eleven percharacterized surveillance rods.

33293 **(DOE/ET/34031—3) 8 x 8 fuel surveillance program at Monticello site - end of Cycle 4: second post-irradiation inspection, September 1975.** Skarshaug, N.H. (General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). Sep 1980. Contract AC02-80ET34031. 19p. NTIS, PC A02/MF A01. Order Number DE81030748.

A fuel surveillance program for the lead 8 x 8 fuel assembly was implemented at the Monticello Nuclear Power Station in May 1974. The first post-irradiation inspection was performed on this fuel assembly, MTB099, in January 1975, after an average burnup of 3900 MWd/MT. Results of that inspection are presented in DOE/ET/34031-2. An interim visual inspection was performed in September 1975 after a cumulative burnup of 7830 MWd/MT. Because the January to September operating period was relatively short, only sipping and a visual inspection were made in September to confirm the mechanical integrity of this fuel bundle. The observation of the September inspection revealed the bundle to be in excellent condition; these observations are summarized in this report.

33294 **(DOE/ET/34031—4) 8 x 8 fuel surveillance program at Monticello site - end of Cycle 5: third post-irradiation inspection, September 1977.** Skarshaug, N.H. (General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). Sep 1980. Contract AC02-80ET34031. 38p. NTIS, PC A03/MF A01. Order Number DE81030749.

A fuel surveillance program for a lead 8 x 8 reload fuel assembly was implemented at the Monticello Nuclear Power Station in May 1974 prior to Reactor Cycle 3. Inspection results of the third post-irradiation inspection performed on this surveillance fuel assembly in September 1977 at EOC 5, after a bundle average exposure of 20,500 MWd/MT, are presented. The measurement techniques, results obtained and comparisons to previous measurements are discussed. The bundle and individual comparisons to previous measurements are discussed. The bundle and individual rods examined exhibited characteristics of normal operation and were approved for continued irradiation during Monticello operating Cycle 6.

33295 **(DOE/ET/34031—5) 8 x 8 fuel surveillance program at Monticello site - end of Cycle 6: fourth post-irradiation inspection, October 1978.** Skarshaug, N.H. (General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). Sep 1980. Contract AC02-80ET34031. 25p. NTIS, PC A02/MF A01. Order Number DE81030750.

A fuel surveillance program for a lead 8 x 8 reload fuel assembly was implemented at the Monticello Nuclear Power Station in May 1974 prior to Reactor Cycle 3. Inspection results of the fourth post-irradiation inspection performed on this surveillance fuel assembly in October 1978 at EOC 6, after a bundle average exposure of 25,900 MWd/MT, are presented. The measurement techniques, results obtained and comparisons to previous measurements are discussed. The bundle and individual rods examined exhibited characteristics of normal operation and were approved for continued irradiation during Monticello operating Cycle 7.

33296 **Hybrid numerical method for homogeneous equilibrium two-phase flows in one space dimension.** Shin, Y.W.; Wiedermann, A.H. (Argonne Natl Lab, Ill). *Journal of Pressure Vessel Technology ;* **103**: No. 1, 20-26(Feb 1981).

A finite difference method is used for field solution while the method of characteristics is employed for treating boundary conditions. The boundary method is a new method that uses an integral procedure for precise specification of boundary values leading to an accurate overall solution. Procedures for many types of boundary conditions commonly encountered in reactor system analyses have been formulated and discussed. Sample problems hae been calculated for two-phase water/steam mixture and single-phase nitrogen gas. The results are presented to demonstrate the degree of accuracy attainable from the hybrid method. The basic method dicussed may be generalized to apply to more general nonequilibrium two-phase flow models with unequal phase velocities provided real characteristics exist.

## 2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

*REFER ALSO TO CITATION(S) 33028, 33318, 33333, 33341, 33342, 33351, 33352, 33353, 33361, 33363*

33297 **(PNL-SA—9641) Engineering study of frequent refueling for improved uranium utilization in pressurized water reactors.** Bernstein, I. (Pacific Northwest Lab., Richland, WA (USA); Combustion Engineering, Inc., Windsor, CT (USA)). May 1981. Contract AC06-76RL01830. 23p. (CONF-810606—98). NTIS, PC A02/MF A01. Order Number DE81030089.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

The most practical alternative to annual refueling appeared to be semiannual refueling, with a short midyear refueling-only outage scheduled during minimum power demand and an annual outage during which maintenance outage tasks would be performed. A method for economic evaluation of frequent refueling was developed using fuel loading requirements, refueling frequency, replacement power costs and the price of uranium oxide as parameters and the economics evaluated with the costs anticipated for the year 1995. It was determined that to obtain breakeven energy costs, the extra semiannual refueling outage would have to be accomplished in six to nine days for most plants. Although it could not practicably be reduced to that level, proposed changes to arrangement, procedures and equipment indicated that an outage of from eleven to thirteen days was possible. Total cost of implementing these changes is estimated at less than 4% of the overall physical plant cost. This cost can be justified based on the time saved during refueling outages over the reactor lifetime. These changes were generally defined while a detailed design review was made of a fuel-handling system which utilizes two cantilever-supported refueling machines and two transfer systems, allowing independent and simultaneous handling of two fuel assemblies during the refueling sequence. A review of the critical path annual maintenance items indicated that these items would probably control the length of the annual refueling outage.

33298 **(UCID—19104) Technical evaluation of the noise and isolation testing of the safety features actuation system at the Davis Besse Nuclear Power Station, Unit 1.** Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 7p. NTIS, PC A02/MF A01. Order Number DE81030473.

This report documents the technical evaluation of the noise and isolation testing of the safety features actuation system at the Davis Besse Nuclear Power Station, Unit 1. The tests were to verify that faults on the non-Class 1E circuits would not propagate to the Class 1E circuits and degrade them below acceptable levels. The tests conducted demonstrated that the safety features actuation system did not degrade below acceptable levels nor was the system's ability to perform its protective functions affected.

**33299 (UCID—19105) Technical evaluation of the station and instrument ground grid systems at the Davis Besse Nuclear Power Station, Unit 1.** Selan, J.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 Jun 1981. Contract W-7405-ENG-48. 4p. NTIS, PC A02/MF A01. Order Number DE81030472.

This report documents the technical evaluation of the station and instrument ground grid systems at the Davis Besse Nuclear Power Station, Unit 1. The evaluation is to determine that there are no inadvertent ties between the instrument and station ground grid systems, that any identified inadvertent ties are corrected, and to assure that the installation meets design criteria. The information submitted by the licensee indicates that there are no inadvertent ties between the station and instrument ground grid systems and that the installation meets design criteria.

## 2103 Power Reactors, Non-breeding, Graphite Moderated

*REFER ALSO TO CITATION(S) 33322*

**33300 (DOE/SF/10748—T2) Fort St. Vrain improvement program plan. Draft final report.** (Proto-Power Management Corp., Groton, CT (USA)). Mar 1980. Contract AC03-79SF10748. 119p. NTIS, PC A06/MF A01. Order Number DE81024220.

The restraints are described which inhibit the Fort St. Vrain (FSV) Nuclear Power Station, a high temperature gas cooled reactor (HTGR) plant, from achieving full power operation with high availability. The actions necessary to overcome these restraints are outlined. The restraints originated from problems in both hardware related and institutional areas. The report summarizes what has been accomplished, what is currently being done, and what should be done to resolve the problems.

## 2105 Power Reactors, Breeding

*REFER ALSO TO CITATION(S) 33344, 33345, 33347, 33354, 33355, 33356, 33357, 33358, 33359, 33364, 33365, 33366*

**33301 (ANL—81-18) TCLUST1: a computer program for analysis of intersubassembly heat transfer in an LMFBR.** Chang, L.K.; Feldman, E.E. (Argonne National Lab., IL (USA)). Apr 1981. Contract W-31-109-ENG-38. 36p. NTIS, PC A03/MF A01. Order Number DE81026474.

The TCLUST1 computer program was developed to study the transient thermal behavior of a subassembly of a liquid-metal fast breeder reactor (LMFBR) that is thermally coupled to its six neighboring subassemblies. Each of the seven subassemblies may be either a reflector subassembly, which contains a single solid hexagonal rod, or a pin-bundle subassembly. The TCLUST1 analytical model was developed based on conservation of energy, and the temperature distribution in the subassembly was obtained using the successive over-relaxation (SOR) technique. Measured temperatures obtained from a natural-convection flow test performed in EBR-II compare well with those predicted by TCLUST1. Appendixes describe the code input and go through a sample program

**33302 (CONF-810941—1) Contribution of Clinch River Breeder Reactor plant design and development to the LMFBR fuel cycle.** Riley, D.R.; Dickson, P.W. (Department of Energy, Oak Ridge, TN (USA). Technical Information Center; Westinghouse Electric Corp., Oak Ridge, TN (USA). Advanced Reactors Div.). 1981. Contract AC15-76CL02395. 11p. NTIS, PC A02/MF A01. Order Number DE81025742.

From ANS technical base for nuclear fuel cycle policy; Newport, RI, USA (20 Sep 1981).

This paper describes how the CRBRP development and CRBRP focus of the LMFBR base technology program have led to advances in the state of the art in physics, thermal-hydraulics, structural analysis, core restraint, seismic analysis, and analysis of hypothetical core-disruptive accident energetics, all of which have been incorporated through disciplined engineering into the final CRBRP design. The total development in the US of fuels and materials, the analytical advances made on CRBRP design, and the incorporation of the latest experimental results into that design have put the US technology in general and the CRBRP design in particular at the forefront of technology. This has placed the US in a position to develop the most favorable LMFBR fuel cycle.

**33303 (CONF-8008111—1) LMFBR fuel-design environment for endurance testing, primarily of oxide fuel elements with local faults.** Warinner, D.K. (Argonne National Lab., IL (USA)). 1980. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01. Order Number DE81023138.

From Nuclear engineering conference; San Francisco, CA, USA (18 Aug 1980).

The US Department of Energy LMFBR Lines-of-Assurance are briefly stated and local faults are given perspective with an historical review and definition to help define the constraints of LMFBR fuel-element designs. Local-fault-propagation (fuel-element failure-propagation and blockage propagation) perceptions are reviewed. Fuel pin designs and major LMFBR parameters affecting pin performance are summarized. The interpretation of failed-fuel data is aided by a discussion of the effects of nonprototypicalities. The fuel-pin endurance expected in the US, USSR, France, UK, Japan, and West Germany is outlined. Finally, fuel-failure detection and location by delayed-neutron and gaseous-fission-product monitors are briefly discussed to better realize the operational limits.

**33304 (DOE/ET/37240—74TR) Manual for use with the computer code SUPERENERGY: data reduction version.** Symolon, P.D.; Todreas, N.E. (Massachusetts Inst. of Tech., Cambridge (USA)). Feb 1980. Contract AS02-76ET37240. 109p. NTIS, PC A06/MF A01. Order Number DE81029718.

A data reduction version of the SUPERENERGY code is presented as a means of calibrating the mixing parameters $\epsilon_1$* and $C_1$ from salt tracer injection experiments. In addition to the older version (SUPERENERGY-DRV-1) which uses a single concentration distribution map to calibrate each mixing parameter, a new version (SUPERENERGY-DRV-2) is presented which utilizes two maps from two different injection levels to calibrate each mixing parameter.

**33305 (EPRI-NP—1973) Achievements, findings, and lessons of the Phenix LMFBR power plant experience. Final report.** Wolfe, W.B. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). Aug 1981. 243p. NTIS, PC A11/MF A01. Order Number DE81904203.

The French 250-MWe Phenix Liquid Metal Fast Breeder Reactor (LMFBR) has become distinguished by its noteworthy record of construction, operation, and maintenance. Heretofore, information about the Phenix experience has been available only in widely scattered articles, reports, and conference papers. EPRI Report NP-1972 summarizes the published Phenix information, emphasizing those aspects of the Phenix experience which are of particular interest in the consideration of LMFBRs for large central station power generation. This report provides the technical details supporting the summary report and discusses the significant findings from the Phenix construction, startup, operation, and maintenance activities.

**33306 (EPRI-NP—1986) Analysis of potential attack on insulating materials exposed to sodium. Final report.** Allam, I.M.; Lamoreaux, R.H.; Loehman, R.E. (SRI International, Menlo Park, CA (USA)). Aug 1981. 72p. NTIS, PC A04/MF A01. Order Number DE81904222.

The use of ceramics for thermally insulating the header of the LMFBR (liquid metal fast breeder reactor) is primarily determined by the chemical compatibility of the ceramics and liquid sodium. A series of thermodynamic calculations of ceramic stabilities as a function of oxygen concentration in the liquid sodium was used to select materials for experimental testing. Several commercial ceramics were exposed to liquid sodium for 10 weeks at 741°K, in a test program aimed at evaluating their suitability as LMFBR insulators.

33307 **Analysis of stresses in GCFR cladding under normal operating conditions.** Liu, Y.Y.; Billone, M.C.; Hsieh, T.C. (Argonne National Lab., IL (USA). Materials Science Div.). *Nuclear Engineering and Design ;* **63**: No. 1, 21-37(Jan 1981).

A modified version of the LIFE-III code, LIFE-GCFR, and classical stress analysis techniques have been employed to calculate the stresses in GCFR cladding under normal reactor operating conditions. Several types of loadings on the cladding which occur during normal operation have been considered. These include fuel-cladding mechanical interaction, thermal stresses induced by radial and axial temperature gradients, and stresses induced by swelling gradients. The combined and individual effects of these loadings as well as the effect of creep on cladding stresses have been assessed. Results obtained from this study have provided input to the experimental GCFR cladding development work at Argonne National Laboratory.

33308 **(GEFR-SP—236) High temperature chemomechanical interactions between alkali metals and urania-base oxide reactor fuels.** Adamson, M.G.; Reineking, W.H. (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). 28 Apr 1981. Contract AT03-76SF71031. 34p. (CONF-810943—4). NTIS, PC A03/MF A01. Order Number DE81029897.

From Conference on chemistry of materials at high temperatures; Harwell, Oxfordshire, UK (7 Sep 1981).

The chemical reactions that occur when alkali metals such as Cs and Rb fission products or Na and K coolants react with urania or mixed urania-plutonia solid solutions at 550 to 1150°C, are accompanied by volume increases that can contribute to swelling in irradiated oxide nuclear fuel and breeder materials. These reactions, and the associated phase equilibria, are somewhat complex, and the actual complex oxide reaction products that form are determined by the relative quantities of alkali metal (A), oxide fuel and available/reactive oxygen, the chemical potentials of A and $O_2$, and temperature. The conditions necessary for formation of the various ternary oxide reaction products are reviewed, then both theoretical estimations and experimental determinations of swelling in several important alkali metal-polycrystalline oxide reaction systems are described. It is shown that reaction swelling in intact or breached LMFBR fuel pins can be modelled with reasonable precision using swelling factors derived from crystallographic densities of the Cs-fuel or Na-fuel reaction products. Potassium reactions, however, are an exception, the experimental reaction swelling being ~ 77% lower than theoretical. It is also shown, principally from FCMI simulation experiments performed on sintered UO/sub 2 + x/ pellets reacting with Cs, that stainless steel cladding generally cannot restrain alkali metal-oxide fuel reaction swelling, however, at initial pellet densities ≦ 80% theoretical this limited restraint may be sufficient to fracture (and hence densify) reacted/embrittled regions of the polycrystalline oxide. The critical load to cause this type of brittle fracture in reacted 80% TD $UO_{2.035}$ was estimated to be ≃ 15 MPa.

33309 **(HEDL-SA—2333-FP) Technique for preparation of prototypic fast test reactor mixed-oxide fuel pins for ceramography and metallography.** Chastain, S.A. (Hanford Engineering Development Lab., Richland, WA (USA)). 1981. Contract AC14-76FF02170. 11p. (CONF-810731—3). NTIS, PC A02/MF A01. Order Number DE81029801.

From 14. annual technology meeting of international metallographic society; San Francisco, CA, USA (21 Jul 1981).

Irradiated liquid metal fast breeder reactor prototypic mixed-oxide fuel and cladding have been sectioned and examined in remote hot cell facilities for ceramographic and metallographic examinations. Metallography, shielded electron microprobe examinations, electron microscopy from replicas and autoradiography are routinely employed to obtain postirradiation data for statistical evaluation. Selection of preparatory techniques are based on fuel type, burnup, customer requirements and fuel pin condition.

33310 **(HEDL-SA—2371) Startup of the FFTF sodium cooled reactor.** Redekopp, R.D.; Umek, A.M. (Hanford Engineering Development Lab., Richland, WA (USA)). Mar 1981. Contract AC14-76FF02170. 25p. (CONF-810812—37). NTIS, PC A02/MF A01. Order Number DE81029779.

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The Fast Flux Test Facility (FFTF), located on the Department of Energy (DOE) Hanford Reservation near Richland, Washington, is a 3 Loop 400 MW(t) sodium cooled fast reactor with a primary mission to test fuels and materials for development of the Liquid Metal Fast Breeder Reactor (LMFBR). Bringing FFTF to a condition to accomplish this mission is the goal of the Acceptance Test Program (ATP). This program was the mechanism for achieving startup of the FFTF. Highlights of the ATP involving the system inerting, liquid metal and inerted cell testing and initial ascent to full power are discussed.

33311 **(HEDL-SA—2386) Utilizing FFTF: the keystone for breeder development.** Ziff, J.J.; Arneson, S.O. (Hanford Engineering Development Lab., Richland, WA (USA)). May 1981. Contract AC14-76FF02170. 7p. (CONF-810812—36). NTIS, PC A02/MF A01. Order Number DE81029810.

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

This paper describes the role of the Fast Flux Test Facility (FFTF) in the US Department of Energy sponsored Liquid Metal Fast Breeder Reactor (LMFBR) Program. The programs that are in place to ensure that the FFTF fulfills its role as an essential key to the development of LMFBR technology are delineated. A detailed FFTF Operating Plan has been developed to present in integrated form the strategy for gaining maximum useful information from the planned FFTF operations. The three principal areas of FFTF Utilization: Plant Utilization, Irradiation Testing, and Safety, combine to form the overall FFTF Operating Plan. Primary areas where FFTF is already making major contributions to LMFBR development are described.

33312 **(ORNL/CSD/TM—126) Thermal-hydraulic differential sensitivity theory.** Maudlin, P.J.; Parks, C.V.; Weber, C.F. (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). Sep 1981. Contract W-7405-ENG-26. 44p. NTIS, PC A03/MF A01. Order Number DE81030371.

Differential sensitivity theory is applied to a nonlinear, three-dimensional space- and time-dependent description of the thermal-hydraulic conservation equations. The resulting sensitivity equations, which are derived using adjoint functions, can be readily utilized for input parameter sensitivity analysis of large or long-running thermal-hydraulic computer codes without any prior engineering judgement. The procedure for applying this sensitivity theory is illustrated using several classical analytical problems.

33313 **Cesium thermomigration and reaction in nuclear fuels.** Fee, D.C.; Johnson, C.E. (Argonne National Lab., IL (USA). Chemical Engineering Div.). *Journal of Nuclear Materials ;* **96**: No. 1/2, 71-79(Jan 1981).

In fast reactor fuel pins with 0.3 m long fuel sections, fission-product cesium has been observed to migrate axially and concentrate at the interface between the uranium-plutonium oxide fuel and the uranium oxide blanket. To aid in the understanding of this behavior, kinetics of the reaction of gaseous cesium with urania have been studied in out-of-pile experiments over the temperature range 600 to 1070 K. The rate of reaction increased with increasing urania temperature, cesium pressure, and O/U atom ratio, and is given by: rate = D[Psub(C)sub(s)(Pa)]$^{0}$sup(.)$^{96}$sup(+-)$^{0}$sup(.)$^{13}$(O/U - 2.000) exp[(- 34 +- 3 kJ/mol)/RT], where D = 9.5 mol Cs $m^{-2}$ $s^{-1}$ $Pa^{-1}$. For in-pile conditions, the rate of reaction of gaseous cesium with a uranium oxide blanket pellet was calculated to be at least $10^3$ times greater than the maximum cesium transport rate, the fission-induced birthrate of cesium. As a consequence of the rapid kinetics, fission-product cesium is expected to form cesium uranate preferentially in the first several urania blanket pellets, but not in the entire blanket. This is in accord with in-pile data.

33314 **Fuel-cladding chemical interaction in uranium-plutonium oxide fast reactor fuel pins.** Fee, D.C.; Johnson, C.E. (Argonne National Lab., IL (USA). Chemical Engineering Div.). *Journal of Nuclear Materials ;* **96**: No. 1/2, 80-104(Jan 1981).

A model of cladding attack is developed based on the formation of a cesium chromate on the cladding inner surface and the formation of a cesium-fuel compound at the cooler, outer edge of

the fuel. These compounds are assumed to be in equilibrium via the gas-phase transport of cesium and/or cesium hydroxide across the fuel-cladding gap. Using thermochemical and kinetic data for the species involved, the model successfully predicts: (a) the observed temperature dependency of cladding attack in EBR-II, DFR, Rapsodie, and Phenix pins; (b) the observed in-pile threshold temperature for cladding attack; (c) the decreased incidence and decreased severity of cladding attack for sphere-pac fuel and for pellet fuel irradiated at low power levels; and (d) the large difference in the temperature dependency of cladding attack between out-of-pile versus in-pile experiments. Furthermore, the model identifies the local temperature difference between the fuel outer surface and the cladding inner surface to be the single most important parameter governing cladding attack.

33315 **Designing against low-cycle fatigue at elevated temperature.** Majumdar, S. (Argonne National Lab., IL (USA). Materials Science Div.). *Nuclear Engineering and Design ;* **63**: No. 1, 121-135(Jan 1981).

Factors that are important in determining low-cycle fatigue damage at elevated temperature are discussed. The linear damage rule for computing creep-fatigue damage is shown to be unsatisfactory in many situations. The damage-rate equations developed at Argonne National Laboratory have been generalized to include multiaxial creep-fatigue under complicated loading histories. Available creep-fatigue data under combined axial-torsion loading can be explained in a consistent manner by the damage-rate approach.

33316 **Development and performance of metal fuel elements for fast breeder reactors.** Walters, L.C.; Kittel, J.H. (Argonne Natl Lab, Idaho Falls, Idaho). *Nuclear Technology ;* **48**: No. 3, 273-280(May 1980).

The reduction in projected sodium outlet temperatures for commercial liquid-metal fast breeder reactors has renewed the interest in metal fuels. The U-Pu-Zr or Th-Pu-U-Zr metal fuel pins, sodium bonded to stainless-steel claddings, will yield high burnup along with adequate fuel-cladding compatibility. High burnup capability is assured by designing the fuel element so that interconnected porosity and fission-gas release occur prior to fuel-cladding contact. The U-Fs/Type 316 stainless-steel-clad driver-fuel element used in the Argonne National Laboratory Experimental Breeder Reactor II is designed to take advantage of the phenomenon of interconnected porosity. 20 refs.

## 2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

33317 **(LA-UR—81-2595) Failure mode analysis using state variables derived from fault trees with application.** Bartholomew, R.J. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 11p. (CONF-810905—5). NTIS, PC A02/MF A01. Order Number DE81030239.

From ANS/ENS topical meeting on probabilistic risk assessment; Post Chester, NY, USA (20 Sep 1981).

Fault Tree Analysis (FTA) is used extensively to assess both the qualitative and quantitative reliability of engineered nuclear power systems employing many subsystems and components. FTA is very useful, but the method is limited by its inability to account for failure mode rate-of-change interdependencies (coupling) of statistically independent failure modes. The state variable approach (using FTA-derived failure modes as states) overcomes these difficulties and is applied to the determination of the lifetime distribution function for a heat pipe-thermoelectric nuclear power subsystem. Analyses are made using both Monte Carlo and deterministic methods and compared with a Markov model of the same subsystem.

## 2107 Regulation And Licensing

*REFER ALSO TO CITATION(S) 33362*

## 2108 Economics

*REFER ALSO TO CITATION(S) 33018, 33019, 33392*

33318 **(BNL—29899) APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste.** Steinberg, M.; Powell, J.R. (Brookhaven National Lab., Upton, NY (USA)). Aug 1981. Contract AC02-76CH00016. 21p. (CONF-810941—3). NTIS, PC A02/MF A01. Order Number DE81030523.

From ANS technical base for nuclear fuel cycle policy; Newport, RI, USA (20 Sep 1981).

The development of a nuclear fission fuel cycle is proposed which eliminates all the radioactive fission product waste effluent and the need for geological-age high level waste storage and provides a long term supply of fissile fuel for an LWR power reactor economy. The fuel cycle consists of reprocessing LWR spent fuel (1 to 2 years old) to remove the stable nonradioactive (NRFP, e.g. lanthanides, etc.) and short-lived fission products (SLFP e.g. half-lives of (1 to 2 years) and returning, in dilute form, the long-lived fission products, ((LLFPs, e.g. 30 y half-life Cs, Sr, and 10 y Kr, and 16 x $10^6$ y I) and the transuranics (TUs, e.g. Pu, Am, Cm, and Np) to be refabricated into fresh fuel elements. Makeup fertile and fissile fuel are to be supplied through the use of a Spallator (linear accelerator spallation-target fuel-producer). The reprocessing of LWR fuel elements is to be performed by means of the Chelox process which consists of Airox treatment (air oxidation and hydrogen reduction) followed by chelation with an organic reagent ($\beta$-diketonate) and vapor distillation of the organometallic compounds for separation and partitioning of the fission products.

33319 **(EPRI-NP—1920) REFUEL: a computer program for automated BWR fuel management. Final report.** Weisman, J. (Cincinnati Univ., OH (USA). Dept. of Chemical and Nuclear Engineering). Jul 1981. 227p. NTIS, PC A11/MF A01. Order Number DE81904196.

The REFUEL computer program has been developed for automated determination of optimum refueling patterns in a BWR. Although REFUEL can determine the refueling patterns for an equilibrium core, its primary focus is on the short-term decisions to be made following operational problems. The REFUEL program can determine the number of fresh assemblies to be added, location and number of burned assemblies to be discharged and the assembly-by-assembly fuel placement at a refueling following deviations from planned operation. The program has been shown to work under a variety of conditions and to have reasonable computer time requirements. Comparisons of core power distribution and burnups with standard programs indicate that the REFUEL nuclear model has the requisite accuracy.

33320 **Fusion-fission hybrid reactors.** Mills, R.G. (Princeton Univ, NJ). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems ;* **PAS-100**: No. 3, 1173-1175(Mar 1981).

Paper No. 80 SM 562-9.

33321 **NASAP and INFCE: the final reports.** Kendrick, H. (US DOE). pp vp of Atomic Industrial Forum, Inc., fuel cycle conference, 1980. Bethesda, MD; Atomic Industrial Forum, Inc. (1980).

From Fuel cycle conference; New Orleans, LA, USA (15 Apr 1980).

The final reports of the Nuclear Alternative Systems Assessment Program and the International Nuclear Fuel Cycle Evaluation are discussed. Major elements are reviewed, particularly their findings and recommendations.

## 2109 Process Heat Reactors

*REFER ALSO TO CITATION(S) 33367*

**33322 (DOE/ET/34222—1) Feasibility of the high temperature gas-cooled reactor for cogeneration of process steam and electric power for a large oil refinery.** (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). Jul 1981. Contract AC02-78ET34222. 134p. NTIS, PC A07/MF A01. Order Number DE81028353.

This report contains the technical and economic evaluation and comparison of a two-unit (1170 MWt each) high temperature gas-cooled reactor (HTGR) plant and a two-unit (1280 MWt each) conventional coal-fired plant for providing the process steam and electricity required for a typical large oil refinery located in the Gulf Coast area. The economics of the HTGR and coal-fired plants are also compared to the costs required for the continued operation of the existing steam and electricity generating facilities at the refinery. The study assumes that these existing facilities are presently operating using fuel oil as the energy source. To the extent that natural gas prices, on a dollar per MBtu basis, are forecasted to approach those for fuel oil for the relevant period (1987 and beyond) in this study, the results and conclusions presented are also applicable to the use of natural gas by the existing facilities.

# 22 NUCLEAR REACTOR TECHNOLOGY

## 2201 Theory And Calculation

**33323 (LA—8950-MS) ENDF/B-V, LIB-V, and the CSEWG benchmarks.** Kidman, R.B. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 99p. (ENDF—314). NTIS, PC A05/MF A01. Order Number DE81032021.

A 70-group library, LIB-V, generated with the NJOY processing code from ENDF/B-V, is tested on most of the Cross Section Evaluation Working Group (CSEWG) fast reactor benchmarks. Every experimental measurement reported in the benchmark specifications is compared to both diffusion theory and transport theory calculations. Several comparisons with prior benchmark calculations attempt to assess the effects of data and code improvements.

## 2202 Components And Accessories

*REFER ALSO TO CITATION(S) 33556*

**33324 (DOE/ET/13511—T8) Development of automated welding process for field fabrication of thick walled pressure vessels.** Schneider, R.A. (Westinghouse Electric Corp., Tampa, FL (USA). Nuclear Equipment Div.). 1981. Contract AC05-78ET13511. 13p. NTIS, PC A02/MF A01. Order Number DE81028914.

Four tasks are repoted on: review of welding processes (complete), adaptation of the GTAW-HW narrow groove process to vertical and horizontal welds, 8-inch thick field demonstration/qualification welds, and welding procedure handbook. (DLC)

**33325 (R/M/N—1068) Measurement of strain across a transition joint interface using Moire fringes.** Hepworth, J.K.; Jolliffe, V.C.; Webster, J.M. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.). Jun 1979. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE81903976.

A Moire fringe method has been used to measure the strain distributions in a plate cut from an English-Electric Mark 3 welded transition joint between 2 1/4 CrlMo and AISI316 heavy section pipes. A cut was sawn along part of the interface between the two materials to simulate a crack and the resulting displacements were measured. The plate was heated to 560°C and the strain distribution at temperature was measured. The plate behaviour was also examined by a finite element analysis and the computed results compared with the experimental measurements.

**33326 (R/M/R—207) Creep damage accumulation during thermal cycling of a transition joint.** Coleman, M.C.; Williams, J.A. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.). Nov 1973. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE81903974.

A creep damage accumulation model has been used to reassess the life of a pressure vessel containing a transition weld between austenitic and ferritic materials, undergoing thermal cycling in the temperature range, 250 to 565°C. Using a published stress analysis for this particular vessel, three possible cyclic deformation modes can be obtained, each depending on the particular test conditions and materials properties. Stress relaxation curves are examined for each care and the accumulated strain per cycle calculated using available uniaxial data for the weakest material in the welded joint. The failure life is defined as the number of cycles to accumulate a critical strain. The effect of hold time on the strain accumulation per cycle is discussed and comparisons made both with previously published life estimates based on fatigue failure models, and with the strain per cycle measured on the vessel. Finally, the implications of the analysis for present and future vessel tests and practical applications are considered.

**33327 (R/M/R—263) Finite element analysis of the stress intensity factors of cracks in welded transition joints.** Jolliffe, V.C. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.). Mar 1978. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE81903972.

The stress intensity factors at the tip of an interfacial crack in a transition weld have been calculated as a function of crack depth using finite elements. There is little variation of stress intensity factor in mode II (in-plane shearing) with weld interface angle, but the stress intensity factor in mode I (opening) can be considerably reduced by increasing the interface angle toward a 90° butt weld. The magnitudes of the strain energy release rate and stress intensity factors are reduced by using a weld metal with a coefficient of thermal expansion intermediate between the two parent metals. A failure criterion would, however, need to take account of material properties.

**33328 (R/M/R—271) Thermal cycling behavior of a cracked transition joint between austenitic and ferritic steels welded with austenitic weld metal.** Jolliffe, V.C.; Williams, J.A. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.). Oct 1978. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE81903975.

CERL/Planar capacitance strain gauges were used during slow thermal cycling experiments to 565°C. The results obtained were reproducible at temperatures above 300°C, but a temperature cycle to 20°C led to gauge offset. The transition joint showed reproducible and reversible strain accumulation during thermal cycling between 300 and 565°C, suggesting that the behaviour under slow thermal cycling was elastic; no pronounced plastic deformation was detected. Displacements at various locations in the joint were determined using finite element analyses of a simplified model of the transition weld. Good agreement was obtained with experimental measurements away from the interface region. The stress state of the transition weld cannot be determined solely by the thermal strains as these only involve the displacements relative to the cycle start temperature. Other factors that are important in defining transition joint life are, for example, the effects of thermal gradients, system and residual stresses and fast cycling.

**33329 Method for controlled stress corrosion cracking in nonsensitized inconel 600 tubing.** Clark, R.A.; Burr, R.L. *Corrosion ;* **36**: No. 7, 382-383(Jul 1980).

The solution developed for stress corroding the Inconel consists of 600 g/L NaOH, 0.1 g/L Cu (electrolytic dust) procedure. 3 refs.

**33330 Focused line source linear array holography using a three dimensional computer reconstruction system.** Collins, H.D.; Hall, T.E.; Wilson, R.L. (Battelle, Pac Northwest Lab, Richland, Wash). *Acoustical Imaging ;* 9: 39-56(1979). (CONF-791263—).

From 9. symposium on acoustics imaging: visualization and characteristics; Houston, TX, USA (3 Dec 1979).

A description is given of a unique holographic scanning configuration and computer reconstruction technique for the inspection of thick-walled nuclear pressure vessels. The holographic imaging system consists of a focused line source and a 120 element receiver array operating at 2.31 MHz. The source and receive arrays are aligned parallel with each other, simulating simultaneous source-receiver scanning in the mechanical scanned direction. The holographic information is obtained by mechanically scanning perpendicular to the arrays and electronically multiplexing the receiver array. The computer reconstruction system is capable of generating near-real time holographic images via an array processor and FFT operation. The system has the unique ability of integrating up to ten images into one three dimensional composite image with the options of tilt and rotation. 6 refs.

## 2204 Control Systems

*REFER ALSO TO CITATION(S) 33321*

**33331 (CONF-810606—71) Janus displays for improved reactor plant operation and control.** Feeley, J.J. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1981. Contract AC07-76ID01570. 7p. NTIS, PC A02/MF A01. Order Number DE81026015.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

Investigations (e.g., reference 1) of the Three Mile Island accident have focused considerable attention on the man-machine interface in nuclear power plants. Currently, plant measurements are displayed on a large number of various meter types distributed over the reactor plant control panel. New approaches use computer based cathode-ray-tube (CRT) display systems to present this data to the operator in a more concise and informative manner. Most CRT display development efforts to date, however, have concentrated on simply improving the presentation of currently available information. This summary describes a fundamentally different technique where, in addition to current data, both past, and predicted future data, are available for display. On a typical Janus display current time is displayed at the center of the CRT, past history is shown to the left, future predictions are shown to the right, and the image scrolls across the screen from right to left as time passes and the display is updated.

**33332 (CONF-810606—72) Optimal calibration of nuclear instrumentation.** Griffith, J.M.; Bray, M.A.; Feeley, J.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 8p. NTIS, PC A02/MF A01. Order Number DE81026016.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

Accurate knowledge of core power level is essential for the safe and efficient operation of nuclear power plants. Ionization chambers located outside the reactor core have the necessary reliability and response time characteristics and have been used extensively to indicate power level. The calibration of the ion chamber, and associated nuclear instrumentation (NI), has traditionally been based on the thermal power in the secondary coolant system. The usual NI calibration procedure consists of establishing steady-state operating conditions, calorimetrically determining the power at the secondary side of the steam generator, and adjusting the NI output to correspond to the measured thermal power. This study addresses certain questions including; (a) what sampling rate should be employed, (b) how many measurements are required, and (c) how can additional power level related information such as primary coolant loop measurements and knowledge of plant dynamics be included in the calibration procedure.

**33333 (EPRI-NP—1982) Evaluation of proposed control room improvements through analysis of critical operator decisions. Final report.** Pew, R.W.; Miller, D.C.; Feeher, C.E. (Bolt, Beranek and Newman, Inc., Cambridge, MA (USA)). Aug 1981. 200p. NTIS, PC A09/MF A01. Order Number DE81904239.

Decision making by nuclear power plant operators was studied in the context of four recent off-normal events in order to assess the potential impact of various control room improvements and innovations. Categories of improvements considered in the study included proposed changes in staff organization and training, controls and displays, and computerized support systems. The evaluation methodology involved judgments by a panel of experts regarding the benefits of proposed improvements for specific operator decisions. It also included the explication of a model of operator decision making and an analysis in terms of this model of how each improvement could help prevent or resolve decision-making errors.

**33334 Proceedings of the Power Plant Dynamics, Control and Testing Symposium, 4th, 1980.** Katz, E.M. (Ed.). pp vp of Fourth power plant dynamics, control and testing symposium. Knoxville, TN; University of Tennessee (1980).

From 4. power plant dynamics, control and testing symposium; Gatlinburg, TN, USA (17 Mar 1980).

This conference contains 22 papers, all of which are abstracted separately. The subject matter is primarily concerned with considerations for dynamics, control, and testing problems for fossil fueled and nuclear systems. Papers deal with modeling, simulation, control, performance evaluation by dynamic testing, plant identification, and plant disturbance analysis.

## 2205 Environmental Aspects

*REFER ALSO TO CITATION(S) 33290, 33826*

**33335 (DOE/OR/06074—1-Vol.3) Nuclear energy center conceptual study. Phase III: site specific evaluation. Topical report, environmental.** (Piedmont Engineers, Greenville, SC (USA)). Jan 1981. Contract AS05-78OR06074. 265p. NTIS, PC A12/MF A01. Order Number DE81027337.

Socio-economic factors related to the proposed siting of a 15000 MW, twelve-unit nuclear energy center in Anderson County, South Carolina, are presented. Topics include: recreational use of Lake Hartwell; terrestrial and aquatic ecology; and atmospheric studies.

## 2206 Research, Test, And Experimental Reactors

*REFER ALSO TO CITATION(S) 33323, 33635*

**33336 (HEDL-SA—2312-FP) Automated remote positioning and examination of FFTF reactor power characterization dosimeters.** Daubert, R.L.; Matsumoto, W.Y. (Hanford Engineering Development Lab., Richland, WA (USA)). 4 May 1981. Contract AC14-76FF02170. 9p. (CONF-810606—76). NTIS, PC A02/MF A01. Order Number DE81025304.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

The Fast Flux Test Facility (FFTF) reactor characterization by the Hanford Engineering Development Laboratory (HEDL) includes extensive neutronic measurements during startup and initial operation. To aid in the handling and counting of the thousands of passive dosimeters used as part of this effort, an automated dosimetry specimen handling, positioning, and counting system was designed and developed by Westinghouse Hanford for the Department of Energy.

**33337 (HEDL-SA—2330-Rev.1) Analysis of in-core coolant temperatures of FFTF instrumented fuels tests at full power.** Hoth, C.W. (Hanford Engineering Development Lab., Richland, WA (USA)). 1981. Contract AC14-76FF02170. 16p. (CONF-810606—77(Rev.1)). NTIS, PC A02/MF A01. Order Number DE81025295.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

Two full size highly instrumented fuel assemblies were inserted into the core of the Fast Flux Test Facility in December of 1979. The major objectives of these instrumented tests are to provide verification of the FFTF core conditions and to characterize temperature patterns within FFTF driver fuel assemblies. A review is presented of the results obtained during the power ascents and during irradiation at a constant reactor power of 400 MWt. The results obtained from these instrumented tests verify the conservative nature of the design methods used to establish core conditions in FFTF. The success of these tests also demonstrates the ability to design, fabricate, install and irradiate complex, instrumented fuel tests in FFTF using commercially procured components.

33338 **(SAND—80-2365) Design and fabrication of the instrumented fuel elements for the Annular Core Research Reactor (ACRR).** Schmidt, T.R.; Sasmor, D.J.; Martin, J.T.; Gonzalez, F.; Cox, D.N. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76DP00789. 51p. NTIS, PC A04/MF A01. Order Number DE81026470.

This report describes the design and fabrication techniques for the instrumented fuel elements of the Annular Core Research Reactor (ACRR). The thermocouple assemblies were designed and fabricated at Sandia Laboratories while the instrumented elements were assembled at Los Alamos Scientific Laboratory. In order to satisfy the ACRR's Technical Specifications, the thermocouples are required to measure temperature in excess of 1800°C under rapid heating conditions. Because of the potentially high failure rates for thermocouples in such environments, the instrumented fuel elements are designed so that the thermocouples can be replaced easily.

33339 **Seismic analysis of ZPR-6 reactor facility.** Ahmed, H.U.; Ma, D. (Argonne National Lab., IL (USA). Engineering Div.). *Nuclear Engineering and Design ;* **63**: No. 1, 157-166(Jan 1981).

A safe shutdown earthquake analysis of ZPR 6 Reactor Facility was conducted through seismic risk analysis, soil-structure interaction analysis, reactor building dynamic time history analysis and equipment response spectrum analysis due to an assumed El Centro earthquake. Several ASME, AISC and ANSI design codes were used to demonstrate the adequacy of this facility and to design several equipment and piping supports.

33340 **Empirical development of irradiation-induced swelling design equations.** Bates, J.F.; Korenko, M.K. (Hanford Eng Dev Lab, Richland, Wash). *Nuclear Technology ;* **48**: No. 3, 303-314(May 1980).

The use of 20% cold-worked Type 316 stainless steel in the Fast Flux Test Facility (FFTF) necessitates the development and periodic review of the design equation describing the irradiation-induced stress-free swelling in this material. The data base and rationale for the current equation are described. The MK 6 equation, is similar to a previous equation, designated the Revision 5 stress-free swelling equation. 6 refs.

## 2209 Reactor Safety

*REFER ALSO TO CITATION(S) 33028*

33341 **(CONF-810606—73) Posttest analysis of international standard problem 10 using RELAP4/MOD7.** Hsu, M.; Davis, C.B.; Peterson, A.C. Jr.; Behling, S.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 8p. NTIS, PC A02/MF A01. Order Number DE81026017.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

RELAP4/MOD7, a best estimate computer code for the calculation of thermal and hydraulic phenomena in a nuclear reactor or related system, is the latest version in the RELAP4 code development series. This paper evaluates the capability of RELAP4/MOD7 to calculate refill/reflood phenomena. This evaluation uses the data of International Standard Problem 10, which is based on West Germany's KWU PKL refill/reflood experiment K9A. The PKL test facility represents a typical West German four-loop, 1300 MW pressurized water reactor (PWR) in reduced scale while maintaining prototypical volume-to-power ratio. The PKL facility was designed to specifically simulate the refill/reflood phase of a hypothetical loss-of-coolant accident (LOCA).

33342 **(CONF-810606—74) Analysis of short-term reactor cavity transient.** Cheng, T.C.; Fischer, S.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 7p. NTIS, PC A02/MF A01. Order Number DE81026021.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

Following the transient of a hypothetical loss-of-coolant accident (LOCA) in a nuclear reactor, peak pressures are reached within the first 0.03 s at different locations inside the reactor cavity. Due to the complicated multidimensional nature of the reactor cavity, the short-term analysis of the LOCA transient cannot be performed by using traditional containment codes, such as CONTEMPT. The advanced containment code, BEACON/MOD3, developed at the Idaho National Engineering Laboratory (INEL), can be adapted for such analysis. This code provides Eulerian, one and two-dimensional, nonhomogeneous, nonequilibrium flow modeling as well as lumped parameter, homogeneous, equilibrium flow modeling for the solution of two-component, two-phase flow problems. The purpose of this paper is to demonstrate the capability of the BEACON code to analyze complex containment geometry such as a reactor cavity.

33343 **(CONF-810806—8) Experimental investigations of two-phase mixture level swell and axial void fraction distribution under high pressure, low heat flux conditions in rod bundle geometry.** Anklam, T.M.; White, M.D. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 22p. NTIS, PC A02/MF A01. Order Number DE81028072.

From Conference on small break loss of coolant accident analysis in LWR's; Monterey, CA, USA (25 Aug 1981).

Experimental data is reported from a series of quasi-steady-state two-phase mixture level swell and void fraction distribution tests. Testing was performed at ORNL in the Thermal Hydraulic Test Facility - a large electrically heated test loop configured to produce conditions similar to those expected in a small break loss of coolant accident. Pressure was varied from 2.7 to 8.2 MPa and linear power ranged from 0.33 to 1.95 kW/m. Mixture swell was observed to vary linearly with the total volumetric vapor generation rate over the power range of primary interest in small break analysis. Void fraction data was fit by a drift-flux model and both the drift-velocity and concentration parameter were observed to decrease with increasing pressure.

33344 **(DOE/ET/37227—T1) General formulation of an HCDA bubble rising in a sodium pool and the effect of nonequilibrium on fuel transport.** Kocamustafaogullari, G.; Chan, S.H. (Wisconsin Univ., Madison (USA). Dept. of Mechanical Engineering and Statistics). Jun 1980. Contract AS02-76ET37227. 54p. (COO—4040-7). NTIS, PC A04/MF A01. Order Number DE81029708.

This report investigates the effect of interfacial nonequilibrium mass transfer and radiative heat transfer on the amount of the fuel vapor condensed before the bubble reaches to the cover-gas region. Consideration is given to a fuel dominated bubble which is assumed to have just penetrated into the sodium pool in a spherical form subsequent to an Hypothetical Core Disruptive Accident (HCDA). The two-phase bubble mixture as it rises through the sodium pool to the cover-gas region is formulated. The formulation takes into account the effects of the nonequilibrium mass transfer at the interfaces and of the radiative cooling of the bubble as well as the kinematic, dynamic and thermal effects of the surrounding fields. The results of calculation for the amount of the fuel vapor condensed before the bubble reaches the cover-gas region are presented over a wide possible range of the evaporation coefficient as well as the liquid sodium-bubble interface absorbtivity. The effects of nonequilibrium mass transfer become more meaningful at the later stage of the bubble rise where the temperature difference between the liquid fuel and the gaseous mixture has been increased. The thermal radiative cooling is found to be very effective in attenuating the fuel content of the bubble; depending on

the value of the liquid sodium-bubble absorbtivity, a great reduction of fuel vapor is found to be possible. As a result, if the condensed fuel falls out of the bubble, the thermal radiation - which condenses out most of the fuel vapor - can effectively prevent and eliminate most of the fuel leaking out of the reactor vessel.

33345 **(DOE/ET/37227—T2) Experimental design for reflection measurements of highly reactive liquid or solid substances with application to liquid sodium.** Chan, S.H.; Gossler, A.A. (Wisconsin Univ., Milwaukee (USA). Coll. of Engineering and Applied Science). 30 Jun 1980. Contract AS02-76ET37227. 59p. (COO—4040-6). NTIS, PC A04/MF A01. Order Number DE81029714.

A versatile goniometer system with associated electronic components and mechanical instruments has been assembled. It is designed to measure spectral, specular reflectances of highly reactive liquid or solid substances over a spectral range of 0.3 to 9 $\mu$ and incidence angles of 12 to 30° off the normal direction. The capability of measuring reflectances of liquid substances clearly distinguishes this experimental design from conventional systems which are applicable only to solid substances. This design has been used to measure the spectral, specular reflectance of liquid sodium and preliminary results obtained are compared with those of solid sodium measured by other investigators.

33346 **(DOE/ET/37227—T4) Surface radiation properties of $ThO_2$ and other reactor materials.** Chan, S.H.; Ma, H.H. (Wisconsin Univ., Milwaukee (USA). Coll. of Engineering and Applied Science). Dec 1979. Contract AS02-76ET37227. 106p. (COO—4040-5). NTIS, PC A06/MF A01. Order Number DE81029770.

The study provides surface radiation properties of three nuclear reactor materials; thorium dioxide, sodium and steel (99 Fe + 1 C). First, based on transmission spectra and Kramers-Kronig analysis, the complex refractive index, which is fundamental to surface radiation property calculations, of $ThO_2$ is presented over a wide spectral range. Then depending on the contacting media, three types of the surfaces are considered. They are the interfaces between $ThO_2$ and Sodium, $ThO_2$ and Steel (99 Fe + 1 C) as well as $ThO_2$ and a gas. For each interface, the spectral interface reflectance from one side of the medium to the other side is evaluated for all wavelengths. These spectral properties are further integrated to yield the total hemisperical properties over a temperature range, 1200 to 6000°K, of interest to reactor safety analysis.

33347 **(DOE/SF/70097—T8) Experimental studies in CDA work-energy attenuation. Quarterly technical progress report No. 22, 1 April- 30 June 1980.** Tobin, R.J. (SRI International, Menlo Park, CA (USA)). 15 Jul 1980. Contract AT03-76SF70097. 5p. NTIS, PC A02/MF A01. Order Number DE81027046.

Ten experiments using water, Freon 113, and Freon 11 as coolant simulants in constant geometry or constant coolant mass configurations have been completed. Preliminary interpretation indicates faster surface displacement, higher upper core pressure, and higher slug impact pressure and impulse with more volatile coolants.

33348 (DPST—81-262, pp 4p, Paper 7) **Seismic design considerations for underground nuclear facilities.** Kuesel, T.R. (Parsons Brinckerhoff Quade and Douglas, Inc., New York, NY). 1981. NTIS, PC A06/MF A01.

In Workshop on seismic performance of underground facilities, February 11-13, 1981, Augusta, Georgia.

In 1977, a study was undertaken of the feasibility and cost of constructing underground nuclear power plants in California. Although quantitative criteria could not be developed, some useful qualitative observations were made; they indicate that the effects of earthquakes on underground rock-sited plants may differ from those on surface plants in a complex manner. (DLC)

33349 **(EPRI-NP—1899) Studies of transition boiling heat transfer with saturated water at 1-4 bar. Final report.** Weisman, J.; Kao, Y.K.; Wang, S.; Pei, B. (Cincinnati Univ., OH (USA). Dept. of Chemical and Nuclear Engineering). Jun 1981. 232p. NTIS, PC A11/MF A01. Order Number DE81904219.

Steady-state and transient transition boiling heat transfer tests with water at low pressures have been conducted using a loop in which the test sections were heated by hot mercury. A revised heat transfer correlation was developed which provides a better fit of all the data. Transient heat transfer data in the transition boiling region were obtained in two separate test sections, in which the transient was initiated by a sudden increase of the water flow rate. Comparison indicates that the new heat transfer correlation also applies to transient data. The rewetting rates were dependent on local void fraction and test section geometry. At high void fractions in the annular test section, the rewetting rate was determined by the availability of cooling water to the heated surface. Phenomenological studies included void fraction measurement, visual and photographic observations and an examination of wall temperature fluctuations. In essentially all the experiments, the water was at the saturation temperature when transition boiling began.

33350 **(EPRI-NP—1945(Vol.2)) Phased-mission system reliability analysis. Volume 2: computer code. Final report.** Fussell, J.B. (Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering). Jul 1981. 119p. NTIS, PC A06/MF A01. Order Number DE81904194.

PHAMAS is a computer program for quantitative analysis of phased missions. From fault tree type models, PHAMAS calculates the reliability characteristics, importance, and expected number of failures as applicable for the TOP event, minimal cut sets, and basic events. The expected number of failures and unreliability of the TOP event can be calculated using approximations as well as the mathematically exact methods. The methodology used by PHAMAS is presented in this manual. The input and output for PHAMAS are described in detail along with a sample problem.

33351 **(EPRI-NP—1999(Vol.1)) Factors affecting post-DNB operation for light water reactors. Final report .** (Combustion Engineering, Inc., Windsor, CT (USA)). Aug 1981. 205p. NTIS, PC A10/MF A01. Order Number DE81904215.

The development of an improved fuel design limit appears to be technically feasible and its implementation into reactor operations appears to be economically attractive for most pressurized water reactor designs. A maximum cladding temperature criterion of 870°K for 15 seconds can be used to avoid damage due to most mechanisms. Analyses have shown that this criterion would be met for the plant transients of interest. Depending on plant-specific design characteristics, the benefits from a post-DNB fuel design limit could range from intermittent improvements in plant availability to a 5% increase in output worth about $12 million per reactor-year. However, additional analysis of fuel rod bow during transients and post-DNB heat transfer is recommended. Also, an industry-wide survey of benefits is recommended prior to proceeding with the development of a post-DNB fuel design limit.

33352 **(EPRI-NP—1999(Vol.2)) Factors affecting post-DNB operation for light water reactors. Final report.** (Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Generation Div.). Aug 1981. 163p. NTIS, PC A08/MF A01. Order Number DE81904221.

The feasibility of implementing a post-DNB fuel design limit (FDL) for Condition II (moderate frequency) events is investigated. The FDL is defined, a comprehensive separate effects investigation is performed, and limits are specified for post-DNB operation. Limiting transients are evaluated using the FDL, and power benefits are determined. A research program required for implementation of the new FDL is formulated. Finally, recommendations are made regarding implementation of the post-DNB FDL in plant licensing.

33353 **(GEND—010-Vol.1) In-vessel inspection before head removal: TMI II: Phase I. (Conceptual development).** Calloway, N.E.; Greenlee, D.W.; Lawrence, G.R.; Paglia, A.L.; Piatt, T.D.; Tucker, B.A. (EG and G Idaho, Inc., Idaho Falls (USA); Babcock and Wilcox Co., New York (USA)). Aug 1981. Contract AC07-76ID01570. 90p. NTIS, PC A05/MF A01. Order Number DE81029492.

The objective of the task is to provide for an internal inspection of the reactor vessel and the fuel assemblies prior to reactor

vessel head removal. Because the degree of damage to equipment and fuel in the TMI-II reactor is not precisely known, it is important that as much information as possible be obtained on present conditions inside the reactor. This information will serve to benchmark the various analyses already completed or underway and will also guide the development of programs to obtain more information on the TMI-II core damage. In addition, the early look will provide data for planning the reactor disassembly program.

33354 **(HEDL-SA—2263-FP) Sodium boiling and mixed oxide fuel thermal behavior in FBR undercooling transients; W-1 SLSF experiment results.** Henderson, J.M.; Wood, S.A.; Knight, D.D. (Hanford Engineering Development Lab., Richland, WA (USA); General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). 1981. Contract AC14-76FF02170. 15p. (CONF-810803—13). NTIS, PC A02/MF A01. Order Number DE81029759.

From Topical meeting on reactor safety aspects of fuel behavior; Sun Valley, ID, USA (2 Aug 1981).

The W-1 Sodium Loop Safety Facility (SLSF) Experiment was conducted to study fuel pin heat release characteristics during a series of LMFBR Loss-of-Piping Integrity (LOPI) transients and to investigate a regime of coolant boiling during a second series of transients at low, medium and high bundle power levels. The LOPI transients produced no coolant boiling and showed only small changes in coolant temperatures as the test fuel microstructure changed from a fresh, unrestructured to a low burnup, restructured condition. During the last of seven boiling transients, intense coolant boiling produced inlet flow reversal, cladding dryout and moderate cladding melting.

33355 **(HEDL-SA—2264-FP) Internal fuel motion as an inherent shutdown mechanism for LMFBR accidents: PINEX-3, PINEX-2, and HUT 5-2A experiments.** Ferrell, P.C.; Porten, D.R.; Martin, F.J. (Hanford Engineering Development Lab., Richland, WA (USA)). 2 Aug 1981. Contract AC14-76FF02170. 14p. (CONF-810803—12). NTIS, PC A02/MF A01. Order Number DE81029760.

From Topical meeting on reactor safety aspects of fuel behavior; Sun Valley, ID, USA (2 Aug 1981).

The PINEX-2 experiment verified the concept of axial internal molten fuel motion within annular fuel, representing an inherent shutdown mechanism for hypothetical transient overpower excursions on the order of 5$/s. The PINEX-3 experiment, simulating a 50 cents/s transient overpower, showed that limitations on the effectiveness of fuel motion may arise from freezing of the fuel and blockage of the internal movement. Analysis of these experiments was performed to assess the physical processes that dominate fuel relocation potential and to apply them to prototypic LMFBR pin conditions. Results indicate that internal fuel motion should be reliable as a shutdown mechanism in LMFBR's for a range of reactivity insertion rates beyond presently available experimental data.

33356 **(HEDL-SA—2272) Transient redistribution of intragranular fission gas in irradiated mixed oxide.** Hinman, C.A.; Randklev, E.H. (Hanford Engineering Development Lab., Richland, WA (USA)). 10 Jul 1981. Contract AC14-76FF02170. 13p. (CONF-810803—11). NTIS, PC A02/MF A01. Order Number DE81029761.

From Topical meeting on reactor safety aspects of fuel behavior; Sun Valley, ID, USA (2 Aug 1981).

Safety analyses for an LMFBR require a knowledge of the fuel and fission gas behavior under transient conditions. Analyses of microstructural data derived from transiently heated, irradiated, mixed oxide fuel specimens have allowed the calculation of the degree of nonequilibrium of intragranular bubbles formed during the transient. It is hypothesized that the observed over-pressurization of the intragranular bubbles mechanically loads the fuel within the grain, leading to a stress gradient derived force upon near-grain-surface bubbles, driving them preferentially to the grain boundaries. Using existing models for forced diffusion it can be estimated that the stress derived forces on bubbles are within the same magnitude, and possibly greater, than the forces derived from the thermal gradient.

33357 **(HEDL-SA—2284-FP) Fuel pin behavior under slow overpower transient conditions; HEDL W-2 SLSF experiment results.** Henderson, J.M.; Seeman, S.E.; Wood, S.A.; Metcalf, I.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Aug 1981. Contract AC14-76FF02170. 13p. (CONF-810803—10). NTIS, PC A02/MF A01. Order Number DE81029795.

From Topical meeting on reactor safety aspects of fuel behavior; Sun Valley, ID, USA (2 Aug 1981).

The HEDL W-2 Sodium Loop Safety Facility (SLSF) Experiment was the first overpower transient test in the US to utilize full-length, fully-preconditioned LMFBR fuel pins. The 7-pin fuel bundle was irradiated for a total of 26 days at a nominal steady-state peak linear pin power level of 42 kW/m (12.8 kW/ft). A 5 cent/s overpower ramp was imposed following five days of continuous steady-state irradiation. Between 10 and 20 seconds into the transient, test instrumentation indicated a limited fuel pin cladding breach. Significant cladding disruption, molten fuel motion, and moderate fuel-coolant interactions occurred at 22 seconds into the transient.

33358 **(HEDL-SA—2288-S) High rate transient mechanical properties of unirradiated fast reactor cladding.** Cannon, N.S.; Hunter, C.W. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1981. Contract AC14-76FF02170. 11p. (CONF-810803—9). NTIS, PC A02/MF A01. Order Number DE81029794.

From Topical meeting on reactor safety aspects of fuel behavior; Sun Valley, ID, USA (2 Aug 1981).

Out-of-reactor simulation of hypothetical transient undercooled overpower (TUCOP) events is required to experimentally support computer model determinations of the time, location and mode of fast reactor fuel pin failure under TUCOP conditions. For this purpose the TUCOP FCTT system was developed at HEDL to test cladding specimens at heating rates to 550°C/s while controlling diametral strain at rates to 0.5/s. Special developmental features of the TUCOP system are (I) rf induction heater control to allow noise free data sampling, and (II) high speed high pressure valves.

33359 **(HEDL-SA—2292-FP) Evaluation of high-pressure containment buildings for LMFBR's.** Armstrong, G.R. (Hanford Engineering Development Lab., Richland, WA (USA)). 1981. Contract AC14-76FF02170. 5p. (CONF-810606—94). NTIS, PC A02/MF A01. Order Number DE81029783.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

A study was conducted on the use of High Pressure LMFBR Containment Buildings for 1000 MW(e) LMFBRs. Two principal aspects were investigated: accident consequence mitigation and cost. Two types of hypothetical accidents were analyzed to establish consequence mitigation: melt-through and energetic expulsion. Three Containment Building (CB) design pressures were investigated: 69 kPa (10 psig), 207 kPa (30 psig), and 414 kPa (60 psig). Four types of design structures were analyzed to establish cost: steel, steel with confinement building, reinforced concrete, and prestressed/post-tensioned concrete. Results show that: it is within reason that a high pressure containment for a 1000 MW(e) reactor can be fabricated that will retain its integrity during postulated severe hypothetical accidents, if available measures are taken to reduce or prevent hydrogen production and the cost differential between basic high (414 kPa) and low (69 kPa) pressure containments is $10 x $10^6$ or less.

33360 **(LA—8971-MS) Propagation of a liquid-liquid explosion.** Harlow, F.H.; Ruppel, H.M. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01. Order Number DE81030780.

Direct contact between two liquids, one cold and the other hot, may be precluded by the presence of a vapor film. Bridging of this film by one or both fluids results in rapid local boiling, which may initiate a propagating liquid-liquid explosion. A mechanism is discussed for the propagation that involves implosion of the film, rapid mixing of the fluids, heat exchange to warm the cold fluid above the temperature for spontaneous nucleation, and the explo-

sive generation of vapor, which in turn continues to sustain the film implosion. Plausibility for the model is demonstrated by means of numerical studies by high-speed computer.

**33361 (ORNL/TM—7980) Population dose estimation from a hypothetical release of 2.4 x $10^6$ curies of noble gases and 1 x $10^4$ curies of $^{131}$I at the Three Mile Island Nuclear Station, Unit 2.** Berger, C.D.; Lane, B.H.; Cotter, S.J.; Miller, C.W.; Glandon, S.R. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 30p. NTIS, PC A03/MF A01. Order Number DE81030701.

Beginning on March 28, 1979, a sequence of events occurred at the Three Mile Island Nuclear Station Unit 2 (TMINS-2) nuclear power reactor which resulted in the accidental release of approximately 2.4 x $10^6$ Ci of noble gases and 13 to 15 Ci $^{131}$I. A comprehensive study of this incident has been reported by the President's Commission on the Accident at Three Mile Island. As part of this study, the Technical Assessment Task Group for the Commission addressed a series of alternative event scenarios, including the potential for a higher release of $^{131}$I. As a continuation of this task, this report presents the estimated collective dose to the population within 50 miles of TMINS-2 from a hypothetical release of 2.4 x $10^6$ Ci of noble gases and 1 x $10^4$ Ci $^{131}$I by the methodology of atmospheric dispersion modeling and population dose estimation through the inhalation, ingestion and immersion exposure pathways.

**33362 (PNL-SA—9316) Application of MORT analysis to emergency preparedness for nuclear power stations.** Smith, M.L.; Desrosiers, A.E.; Donaldson, D. (Pacific Northwest Lab., Richland, WA (USA); Nuclear Regulatory Commission, King of Prussia, PA (USA). Region I). Feb 1981. Contract AC06-76RL01830. 19p. (CONF-8106144—4). NTIS, PC A02/MF A01. Order Number DE81030106.

From Health Physics Society annual meeting; Louisville, KY, USA (21 Jun 1981).

Chapter 10 CFR 50.47 of the Code of Federal Regulations specifies that the sixteen emergency planning standards in NUREG-0654 must be met by the licensee. The task of evaluating the degree to which the licensee's emergency preparedness program meets the 16 planning standards and 96 associated criteria upon which the 16 standards are based was the problem facing the NRC. Equally important is the task of appraising the state of readiness of the licensee to actually respond to emergencies that might arise. To evaluate the effectiveness of the licensee program to implement their emergency plan, a Management Oversight and Risk Tree (MORT) approach was developed for use by NRC teams who would be appraising the adequacy of the licensee's implementation program. The application of the MORT technique to evaluate the effectiveness of Emergency Plan Implementation is the subject of this paper.

**33363 Brazing of sensors for high-temperature steam instrumentation systems.** Moorhead, A.J.; Morgan, C.S.; Woodhouse, J.J.; Reed, R.W. (Oak Ridge Natl Lab, Tenn). *Welding Journal (Miami) ;* **60**: No. 4, 17-28(Apr 1981).

Procedures are developed for brazing a ceramic-to-metal seal and for laser welding of sensor subassemblies into tube walls, induction brazing thermocouples through a tube wall, and furnace brazing triaxial cables, thermocouples, and a vent tube to a guide tube study three-dimensional phenomena in the upper plenum and core of a pressurized water reactor during the reflood stage of a loss-of-coolant accident. 8 refs.

**33364 Pressure transient analysis of elbow-pipe experiments using the PTA-2 computer code.** Youngdahl, C.K.; Kot, C.A.; Valentin, R.A. (Argonne Natl Lab, Ill). *Journal of Pressure Vessel Technology ;* **103**: No. 1, 33-42(Feb 1981).

Severe hydraulic transients may be produced in the intermediate heat transport system of a liquid-metal-cooled breeder reactor by a sodium/water reaction in a failed steam generator. The PTA-2 computer code has been developed to analyze these transients, including the effects of plastic deformation of the piping and cavitation on pulse propagation. Comparisons are shown between PTA-2 predictions and the results of two experiments performed at Stanford Research Institute. Excellent agreement between computation and experiment was obtained for dynamic strain and pressure distributions and the location and duration of the cavitation. The effect of elbow curvature on pulse propagation was found to be masked by pipe plasticity effects.

**33365 Modeling deformation and failure of fast reactor cladding during simulated accident transients.** Kramer, J.M.; Dimelfi, R.J. (Argonne National Lab., IL (USA). Reactor Analysis and Safety Div.). *Nuclear Engineering and Design ;* **63**: No. 1, 47-54(Jan 1981).

An analysis is made of burst experiments performed on neutron irradiated cladding tubes. This is done by employing a generalized Voce equation to describe the mechanical deformation of type 316 stainless steel, combined with an empirical creep crack growth law, each modified to account for the effects of irradiation matrix hardening, and irradiation induced grain boundary embrittlement, respectively. The results of this analysis indicate that for large initial hoop stress, failure occurs at relatively low temperature and is controlled by the onset of plastic instability. The increase in failure temperature of irradiated material, in low temperature region, is due to irradiation strengthening. Failure in the case of relatively small initial hoop stress occurs at high temperature where the Voce equation reduces to a power law creep formula. The ductility of irradiated material, in this high temperature region, is adequately described through the use of an empirical intergranular crack growth law used in conjunction with the creep law. The effect of neutron irradiation is to reduce the activation energy for crack propagation from the value for creep to some lower value correlated to independent Dorn rupture parameter measurements. The result is a predicted reduced ductility which translates into a reduction in failure temperature at a given hoop stress value for irradiated material.

**33366 Parametric study of multichannel molten cladding motion under unprotected loss-of-flow accident conditions in LMFBR's.** Chen, W.L.; Ishii, M. (Argonne National Lab., IL (USA). Reactor Analysis and Safety Div.). *Nuclear Engineering and Design ;* **61**: No. 3, 347-367(Dec 1980).

One of the key assumptions of the present multichannel clad motion model was that the total pressure drop over the voided channel could be supplied as a boundary condition. The incoherency effect on cladding motion can be significant for a full-scale subassembly, and therefore parametric studies of the total pressure drop and oscillatory pressure effect due to sodium chugging were examined using the multichannel model. There is an axial blanket region in demonstration plant or commercial-power-plant design instead of a reflector in FFTF design above the top of fuel. It was shown that due to the difference in the thermal conductivities between the blanket material and reflector, significant changes in the timings of various of the cladding relocation might occur. It is also noted that depending on the effect of the sodium voiding on the reactivity, the fuel may become molten when the molten cladding is still around. The possibility of the occurence of this situation is studied by increasing the power in the present model.

**33367 Loss-of-feed water transients in PWR U-tube steam generators: simulation experiments and analysis.** Kalra, S.P.; Duffey, R.B.; Adams, G. (EPRI, Palo Alto, Calif). *AIChE (American Institute of Chemical Engineers) Symposium Series ;* **76**: 36-44(1980).

A description is given of total loss and partial loss-of-feed (LOF) to the steam generator. A 1/7th-scale model of a typical commercial steam generator was used for these tests. The transients were initiated from a range of steady-state conditions which represent operating conditions for a typical commercial steam generator. The variations of dome pressure, pressure loss across the U-tube bundle, exit vapor flow rate, primary inlet temperature and primary temperature drops and circulation ratio during LOF transients are presented. Predictions are also included which are based on a simple analytical model and a three-dimensional numerical code, URSULA-2, the purpose being to benchmark such analyses against integral test data and against each other. 9 refs.

# 25 ENERGY STORAGE

## 2502 Compressed Gas

33368 **(DOE/OR/90337—T1) Thermodynamic behavior of compressed air energy storage systems.** Marinacci, D.J. (West Virginia Univ., Morgantown (USA)). 1978. Contract AS05-76OR90337. 217p. NTIS, PC A10/MF A01. Order Number DE81030349.

Thesis.

The results of thermodynamic performance analyses that were conducted for several Compressed Air Energy Storage (CAES) systems (base, recuperator, and thermal energy storage) are presented and discussed. The analyses presented involved the operation of the WVU CAES computer program model, which is available to potential users, over a wide range of operating conditions which also served as a check on the validity of the model. The first step in the performance assessment study was the optimization analysis. Padgett's SHOP program was used to determine the operating values for the CAES systems which would produce the maximum possible CAES cycle efficiency within the imposed physical limitations. Once the optimum values were determined, selected operating conditions were then independently varied; while the remaining terms were each held at their optimum value during a parametric study. A parametric study was performed for each of the important operating conditions to determine their relative effect on the CAES cycle efficiency and heat rate. Since their effect on the CAES cycle efficiency was significant, parametric studies were performed for each of the three CAES systems modeled with the WVU CAES computer model for the following variables: the LP compressor pressure ratio, RCA; the initial HP compressor pressure ratio, RCCT; the HP compressor discharge pressure, P4; the HP turbine pressure ratio, 1/EXPA1; the LP turbine pressure ratio, 1/EXPA2; the aftercooler discharge temperature, T5; the HP turbine inlet temperature, T10; and the LP turbine inlet temperature, T12. General comments are also given on the advantages and disadvantages of the recuperator and the heat storage systems with respect to the base CAES power cycle. Recommendations for the most thermodynamic efficient design of CAES power plants are given. (WHK)

33369 **(EPRI-EM—1589(Vol.9)(App.C)) Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 9. Design approaches: CAES, Appendix C. Major mechanical equipment. Final report.** (Potomac Electric Power Co., Washington, DC (USA); Acres American, Inc., Buffalo, NY). Apr 1981. Contract AC02-77ET28013. 108p. NTIS, PC A06/MF A01. Order Number DE81030672.

This appendix documents the development of the design approach for the major mechanical equipment making up the Compressed Air Energy Storage (CAES) plant surface facilities. The major mechanical equipment includes the turbine-motor/generator, compressor train, intercooler/aftercooler system, and exhaust gas recuperator. The design criteria for each of these components is interrelated with, and dependent upon, each of the other components within the major mechanical equipment group. Careful consideration of this dependency has resulted in an overall design approach which satisfies the requirements of the CAES operational cycle while providing for a conservative component design.

33370 **(PNL-SA—9782) Reservoir stability studies.** Doherty, T.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1981. Contract AC06-76RL01830. 9p. (CONF-810833—9). NTIS, PC A02/MF A01. Order Number DE81030099.

From Mechanical, magnetic, and underground energy storage 1981 annual contractors' review meeting; Washington, DC, USA (24 Aug 1981).

The objective of the reservoir stability studies project is to develop stability criteria for large underground reservoirs in salt domes, hard rock caverns, and porous rock structures for air storage in utility applications. Because reservoir stability was deemed crucial to commercialization of compressed air energy storage (CAES) systems this project has received major emphasis in the early phases of the overall CAES program. A long term plan, including state-of-the-art assessment, numerical model development and experimental studies culminating in field research, as necessary, was formulated. This plan, initiated in 1977, has been completed during FY-1981 to the stage of specific experimental studies and field research. Activities within this project during FY-1981 have included completion of site specific geotechnical design evaluations using methodologies developed to assess hard rock cavern stability, implementation of in-mine research to evaluate numerical and laboratory study conclusions on the response of domal salt, and preparation of integrated laboratory and field study facilities to assess developed predictive methods and determine in situ response of a porous media reservoir to air injection. The major activity in the project has been the field study component of the porous media studies. Accomplishments there have included completion of exploration, permitting and leasing, operation contractor selection and negotiation, and initiation of procurement and construction for an FY-1982 test initiation. A major program milestone, drilling of the injection withdrawal well for this test, was completed ahead of schedule.

## 2503 Pumped Hydro

33371 **(EPRI-EM—1589(Vol.8)) Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 8. Design approaches: UPH. Final report.** (Potomac Electric Power Co., Washington, DC (USA); Acres American, Inc., Buffalo, NY). Jun 1981. Contract AC02-77ET28013. 297p. NTIS, PC A11/MF A01. Order Number DE81030673.

The development of the design approaches used to determine the plant and overall layout for an underground pumped hydroelectric (UPH) storage facility having a maximum generating capacity of 2000 MW and a storage capacity of 20,000 MWh is discussed. Key factors were the selection of the high head pump-turbine equipment and the geotechnical considerations relevant to the underground cavern designs. The comparison of pump-turbine alternatives is described leading to the selection for detailed study of both a single-step configuration, using multistage reversible pump-turbines, and a two-step configuration, with single-stage reversible pump-turbines. Preliminary review indicated that the nominal head on the pump-turbines would be about 4600 ft. The major components for each of the two configurations, including the upper (surface) reservoir, shafts, heavy hoist, power plant and lower (underground) reservoir, were investigated for this nominal head of 4600 ft. Costs appropriate to nominal heads of 3800 ft and 5000 ft were also estimated to assess the impact of design head on overall project cost. The optimum nominal head for each configuration was determined, taking into account the cost/depth relationship and the head limitations imposed by pump-turbine and motor-generator design. Overall configuration layouts were finalized accordingly. The report recommends, as the basis for subsequent preliminary plant design, the adoption of the two-step configuration with single-stage reversible pump-turbines and an overall nominal head of 5000 ft. Some of the material given in this volume has been modified in the course of the preliminary plant design. The finally adopted arrangement is described in Volume 11, Plant Design - UPH.

## 2505 Flywheels

*REFER ALSO TO CITATION(S) 33129*

## 2506 Thermal

*REFER ALSO TO CITATION(S) 33461*

33372 **(COO—4703-26) Lightweight concrete materials and structural systems for water tanks for thermal storage. Final report.** Buckman, R.W. Jr.; Elia, G.G.; Ichikawa, Y. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.). Dec 1980. Contract AC02-78CS34703. 98p. NTIS, PC A05/MF A01.

Thermally efficient hot water storage tanks were designed, fabricated and evaluated. The tanks were made using cellular con-

crete at a nominal density of 100 lb/ft³ for the structural elements and at a 30 lb/ft³ density for the insulating elements. Thermal performance testing of the tanks was done using a static decay test since the test procedure specified in ASHRAE 94-77 was not experimentally practical. A series of composition modifications to the cellular concrete mix were investigated and the addition of alkaline resistant glass fibers was found to enhance the mechanical properties at no sacrifice in thermal behavior. Economic analysis indicated that cellular concrete provides a cost-effective insulating material. The total portability of the plant for producing cellular concrete makes cellular concrete amenable to on-site fabrication and uniquely adaptable to retrofit applications.

33373 **(DOE/RL/01830—T6) United States Department of Energy thermal energy storage program.** Swisher, J.H.; Frier, W.A. (Department of the Air Force, Los Angeles, CA (USA); Battelle Pacific Northwest Labs., Richland, WA (USA)). 1981. Contract AI01-78CS35217;AC06-76RL01830. 36p. NTIS, PC A03/MF A01. Order Number DE81030263.

The objective of the US Department of Energy Thermal Energy Storage Program is to develop devices, processes, and subsystems that permit domestic energy resources to be supplied at the time and locations where they can be used. The program emphasis is in five principal areas: (1) daily storage for active or passive solar and conventional heating and cooling, (2) seasonal storage for building heating and cooling, (3) thermal energy transport, (4) thermal power storage, and (5) chemical heat pumps. The program has a budget of $15.35 million for 1981. The program is reviewed.

33374 **(PNL—3645) Bibliography of the seasonal thermal energy storage library.** Prater, L.S.; Casper, G.; Kawin, R.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Aug 1981. Contract AC06-76RL01830. 310p. NTIS, PC A14/MF A01. Order Number DE81030470.

The Main Listing is arranged alphabetically by the last name of the first author. Each citation includes the author's name, title, publisher, publication date, and where applicable, the National Technical Information Service (NTIS) number or other document number. The number preceding each citation is the identification number for that document in the Seasonal Thermal Energy Storage (STES) Library. Occasionally, one or two alphabetic characters are added to the identification number. These alphabetic characters indicate that the document is contained in a collection of papers, such as the proceedings of a conference. An Author Index and an Identification Number Index are included. (WHK)

33375 **(PNL—3769) Review of simulation techniques for aquifer thermal energy storage (ATES).** Mercer, J.W.; Faust, C.R.; Miller, W.J.; Pearson, F.J. Jr. (Pacific Northwest Lab., Richland, WA (USA); GeoTrans, Inc., Herndon, VA (USA); INTERA Environmental Consultants, Inc., Houston, TX (USA)). Mar 1981. Contract AC06-76RL01830. 225p. NTIS, PC A10/MF A01. Order Number DE81029943.

The storage of thermal energy in aquifers has recently received considerable attention as a means to conserve and more efficiently use energy supplies. The analysis of aquifer thermal energy storage (ATES) systems will rely on the results from mathematical and geochemical models. Therefore, the state-of-the-art models relevant to ATES was reviewed and evaluated. These models describe important processes active in ATES including ground-water flow, heat transport (heat flow), solute transport (movement of contaminants), and geochemical reactions. In general, available models of the saturated ground-water environment are adequate to address most concerns associated with ATES; that is, design, operation, and environmental assessment. In those cases where models are not adequate, development should be preceded by efforts to identify significant physical phenomena and relate model parameters to measurable quantities. Model development can then proceed with the expectation of an adequate data base existing for the model's eventual use. Review of model applications to ATES shows that the major emphasis has been on generic sensitivity analysis and site characterization. Assuming that models are applied appropriately, the primary limitation on model calculations is the data base used to construct the model. Numerical transport models are limited by the uncertainty of subsurface data and the lack of long-term historical data for calibration. Geochemical models are limited by the lack of thermodynamic data for the temperature ranges applicable to ATES. Model applications undertaken with data collection activities on ATES sites should provide the most important contributions to the understanding and utilization of ATES. Therefore, the primary conclusion of this review is that model application to field sites in conjunction with data collection activities is essential to the development of this technology.

## 2509 Batteries

*REFER ALSO TO CITATION(S) 33263, 33263, 33263, 33492*

33376 **(ANL—81-14) Calcium/metal sulfide battery development program. Progress report, October 1979-September 1980.** Barney, D.L.; Roche, M.F.; Preto, S.K.; Ross, L.E.; Otto, N.C.; Martino, F.J. (Argonne National Lab., IL (USA)). Mar 1981. Contract W-31-109-ENG-38. 24p. NTIS, PC A02/MF A01.

A Ca-Al-Si/$FeS_2$ cell has been developed and has exhibited reasonably stable capacity through 3200 h of operation. This system is expected to be capable of meeting the ultimate performance goals (i.e., 160 W.h/kg) of this development program. Further tests of this cell system in the coming year will better define its ultimate performance capabilities.

33377 **(BNL—51370) Investigation of the zinc electrode reaction. Annual report, October 1, 1979-September 30, 1980.** McBreen, J. (Brookhaven National Lab., Upton, NY (USA)). Dec 1980. Contract AC02-76CH00016. 138p. NTIS, PC A07/MF A01. Order Number DE81030221.

The excellent performance characteristics of the nickel-zinc battery make it an attractive option for both all-battery and hydride electric vehicles. Commercialization of the battery has been delayed because of limited cycle life particularly under conditions of deep discharge. In nickel-zinc batteries, with pasted zinc electrodes, zinc electrode shape change or redistribution of the active material from the edge of the electrodes toward the center has been the major life-limiting factor. In batteries with soluble free electrolyte zinc electrodes, morphology changes, particularly under random cycling conditions, is a major operational problem. The present work was focussed on finding insights and possible solutions to these two problems. The areas covered in the work were (1) additive and substrate effects on zinc electrode morphology; (2) investigations of zinc electrodes of the second kind; (3) separator effects on zinc electrode shape change; and (4) investigation of the effect of modified charging methods on the morphology and behavior of both pasted and soluble free electrolyte zinc electrodes.

33378 (LBL—12000, pp 471-493) **Energy storage.** Evans, J.W.; Muller, R.H.; Newman, J.; Ross, P.N.; Tobias, C.W. Jun 1981. NTIS, PC A24/MF A01. Order Number DE81027828.

In Materials and Molecular Research Division annual report 1980.

The overall aim of this program is to improve the energy efficiency, lower the capital cost, and increase the materials yield of electrochemical processes employed in the direct conversion of chemical to electrical energy in galvanic cells and in the production of materials by electrolysis.

33379 (LBL—12000, pp 519-523) **Improved beta-alumina electrolytes for advanced storage batteries.** De Jonghe, L.C. Jun 1981. NTIS, PC A24/MF A01. Order Number DE81027828.

In Materials and Molecular Research Division annual report 1980.

33380 **(UCID—19178) Preliminary design and analysis of aluminum-air cells providing for continuous feed and full utilization of anodes.** Cooper, J.F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Aug 1981. Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01. Order Number DE81030479.

Rapidly-refuelable cells of earlier design (M1 series), featuring anodes of uniform thickness, may require the eventual removal of an unconsumed residual. Wedge-shaped cells, in which the active electrode surfaces form an acute angle, may provide for full anode utilization, continuous feed of anode material to the cell, and partial anode recharge. The advantages, disadvantages, and engineering problem areas of the wedge-shaped cells (M1-CF series) are reviewed. The importance of solution-side current collection to the practicality of this approach when used with alkaline electrolytes is identified. The relationship between cell height and total anode mass is derived for this and corresponding cells of the M1 design. It is concluded that the M1-CF design may provide the basis for an automotive battery of greater simplicity, reliability, and economy than earlier designs, provided that the engineering problems unique to this approach are overcome.

# 29 ENERGY PLANNING AND POLICY

*REFER ALSO TO CITATION(S) 33374, 33483*

33381 **(NTISUB/C—221-404) Technical reports of the Federal Energy Administration. Cumulative through June 30, 1977.** Nicoletti, N. (comp.). (Federal Energy Administration, Washington, DC (USA)). Oct 1977. 148p. (FEA/B—77/226). NTIS. Order Number DE81029832.

This bibliography updates and replaces the previous bibliography (NTIS/C/221-403) dated July 1977. It contains citations for technical reports produced by the Federal Energy Administration (FEA) and its contractors that have been entered into the National Technical Information Service (NTIS) through June 30, 1977.

## 2901 Energy Analysis And Modeling

*REFER ALSO TO CITATION(S) 33383*

## 2902 Economics And Sociology

*REFER ALSO TO CITATION(S) 32980, 32981, 32982, 32983, 32996, 32998, 33272, 33400, 33409, 33411, 33412, 33417, 33430, 33431, 33447, 33835*

33382 **(PNL—3799) Public perceptions of industrial risks: the context of public attitudes toward radioactive waste.** Earle, T.C. (Battelle Human Affairs Research Center, Seattle, WA (USA)). Jun 1981. Contract AC06-76RL01830. 76p. (BHARC—411). NTIS, PC A05/MF A01. Order Number DE81030676.

A survey was made to determine the public risk perception of several industrial hazards. A free response approach was used in order for respondents to generate their own alternatives. The general class of hazard investigated here included all hazardous industrial facilities. The free response survey was used to study public perception of: (a) the closeness of the nearest hazardous industrial facility (as estimated by the respondent); (b) the sort of facility it is; (c) the sorts of risk associated with it; and (d) the persons placed at risk by it. Respondents also identified the risks of, and the persons placed at risk by, both a toxic chemical disposal facility and a nuclear waste disposal facility. Results of this study thus can inform us of the unprompted concerns of the public regarding a wide variety of industrial facilities.

33383 **(UCRL—53131) Methodology and basic algorithms of the Livermore Economic Modeling System.** Bell, R.B. (Lawrence Livermore National Lab., CA (USA)). 17 Mar 1981. Contract W-7405-ENG-48. 43p. NTIS, PC A03/MF A01. Order Number DE81029430.

The methodology and the basic pricing algorithms used in the Livermore Economic Modeling System (EMS) are described. The report explains the derivations of the EMS equations in detail; however, it could also serve as a general introduction to the modeling system. A brief but comprehensive explanation of what EMS is and does, and how it does it is presented. The second part examines the basic pricing algorithms currently implemented in EMS. Each algorithm's function is analyzed and a detailed derivation of the actual mathematical expressions used to implement the algorithm is presented. EMS is an evolving modeling system; improvements in existing algorithms are constantly under development and new submodels are being introduced. A snapshot of the standard version of EMS is provided and areas currently under study and development are considered briefly.

## 2903 Environment, Health, And Safety

*REFER ALSO TO CITATION(S) 32865, 32866, 32998, 33447, 33761, 33770, 33839, 33840, 33920, 33921*

33384 **(DOE/EP—0006) Managing large-scale models: DBS.** (USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC). May 1981. 319p. NTIS, PC A14/MF A01. Order Number DE81028683.

A set of fundamental management tools for developing and operating a large scale model and data base system is presented. Based on experience in operating and developing a large scale computerized system, the only reasonable way to gain strong management control of such a system is to implement appropriate controls and procedures. Chapter I discusses the purpose of the book. Chapter II classifies a broad range of generic management problems into three groups: documentation, operations, and maintenance. First, system problems are identified then solutions for gaining management control are disucssed. Chapters III, IV, and V present practical methods for dealing with these problems. These methods were developed for managing SEAS but have general application for large scale models and data bases.

## 2904 Natural Resources

*REFER ALSO TO CITATION(S) 32898, 33811*

33385 **(EMD—81-53) Minerals management at the Department of the Interior needs coordination and organization.** (General Accounting Office, Washington, DC (USA)). 6 Jun 1981. 77p. General Accounting Office, Gaithersburg, MD. Order Number DE81904048.

Report to the Congress by the Comptroller General of the United States.

In its work on the importance of materials availability, GAO is conducting a continuing evaluation of the federal policymaking process for meeting industrial and strategic materials requirements. An important element of that process is minerals management on federal lands. GAO found that the Department of the Interior lacks a coherent minerals management policymaking process, which can result in an imbalanced consideration of mineral resource management. Decisionmaking is fragmented among surface management agencies, without a requirement for consistent or cumulative evaluation of implications for domestic mineral policy. Therefore, to provide balance between policies for mineral exploration and development and other, more explicitly stated policy objectives, GAO is recommending that the Secretary of the Interior develop a minerals management program plan. Setting fundamental objectives for which mineral resources will be managed should be a first step.

33386 **Basic facts about Colorado's energy resources and reserves.** *Colorado Energy Factbook ;* 23-26(16 Aug 1978).

Some basic facts about Colorado's energy resources and reserves as well as the state's energy production and consumption patterns are presented. Energy sources discussed are coal, oil and gas, oil shale, uranium, solar energy, wind power, biomass, and electricity. The following facets are explored for each energy type: what is it; where is it; how much is there; how do we get it; and what are the issues. Some tables and graphs are included. (BLM)

## 2905 Research, Development, Demonstration, And

## Commercialization

*REFER ALSO TO CITATION(S) 33082, 33405, 33450, 33451, 33452, 33453, 33454, 33455, 33456*

**33387 (BNL—29857) Application of an LP model to strategic planning of multinational cooperative RD and D programs.** Sailor, V.L. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 10p. (CONF-811006—4). NTIS, PC A02/MF A01. Order Number DE81029325.

An analytical study was initiated to serve as a basis for defining a cooperative strategy for RD and D among International Energy Agency member nations. A flexible energy system model, MARKAL, was developed as the primary tool for the analysis. The flexibility of MARKAL is demonstrated by the fact that the diverse energy systems of sixteen countries and the aggregated European Economic Community have been modeled successfully. MARKAL is a multi-period linear programming model which describes the energy flows, costs, and resource consumption of national energy systems over an extended period of time (1980 to 2020). Various policy options and assumptions about future world situations create a range of scenarios which control the MARKAL solutions. This paper describes how such options and such postulated conditions were translated into operational indicators to drive the MARKAL model and constrain its solutions.

**33388 (DOE/ET/13113—T2) Combustion systems project appraisal analysis. Final report.** (TRW, Inc., McLean, VA (USA). Energy Systems Planning Div.). Jun 1979. Contract AC03-77ET13113. 106p. NTIS, PC A06/MF A01. Order Number DE81024167.

The objective of the annual Division of Fossil Fuel Utilization Project Appraisal is to rank all RD and D projects within each branch, and subsequently within the division, based upon the estimated benefits to be derived by the federal participation in the RD and D activity. These benefits are computed as consistently as possible via analytical methodology. The ultimate use of these rankings is as one of the inputs in the preparation of the initial budget request, in this case, that for Fiscal Year, 1981. This report presents the project appraisal analysis results for the projects under cognizance of the Combustion Systems Branch of DFFU. For this analysis, the combustion systems program was segregated into four technologies. Three of these technologies are fluidized-bed combustion while the fourth is coal-oil mixtures. They support the prime objectives of the combustion systems activity as presented in Reference 1, and are: to develop fluidized-bed combustion systems capable of directly burning high-sulfur and other coals of all ranks and quality in an environmentally acceptable manner; and to develop technology to substitute coal for a substantial portion of oil in combustors capable of firing coal-oil mixtures. The fluidized-bed combustion projects are atmospheric fluidized-bed combustion technology for the industrial market, atmospheric fluidized-bed combustion technology for the utility market, and pressurized fluidized-bed technology for the utility market. The market sectors for the coal-oil mixture technology are industrial and utility. Each project was evaluated at three levels of DOE R and D funding. These funding levels were defined as minimum, current and enhanced. Table 1 presents the components for each technology at the three funding levels which define the 12 projects evaluated in the Combustion Systems Project Appraisal Analysis.

**33389 Appropriate energy technology in the US Pacific territories.** Case, C.W. (Lawrence Berkeley Lab., CA); Schaller, D.A. *Solar Law Reporter ;* **2**: No. 6, 1083-1102(Mar 1981).

Appropriate energy technology (AET) programs funded by DOE are described. Specific grants made to Satawan Island, Romanum Island, Guam, Yap, Saipan, and American Samoa are described in detail; all made use of solar energy. Rising petroleum prices have disrupted the economy of these island territories and alternate energy sources are needed. Lack of information, remoteness, lack of infrastructure, and failure to involve local governments have hindered AET development. It is pointed out that some projects have achieved success with good local direction, use of local materials and labor, and a discrete goal. Future AET projects should enjoy greater success and the lessons learned in the Pacific may be helpful in AET projects elsewhere in the developing world. 34 references. (MJJ)

## 2906 Nuclear Energy

*REFER ALSO TO CITATION(S) 32984, 33061, 33382*

**33390 (DOE/EIA/10612—T26) Evaluating the role of uncertainty in electric utility capacity planning.** Soyster, A.L. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). 31 Aug 1981. Contract AC01-80EI10612. 160p. NTIS, PC A08/MF A01. Order Number DE81029287.

This final report on Evaluating the Role of Uncertainty in Electric Utility Capacity Planning is divided into separate sections addressing demand, supply and the simultaneous consideration of both and describes several mathematical characterizations of the effects of uncertainty on the capacity expansion decision. The basic objective is to develop more robust models which can appropriately include the fundamental uncertainties associated with capacity expansion planning in the electric utility industry. Much of what has been developed in this project has been incorporated into a long-term, computer model for capacity expansion planning. A review is provided of certain deterministic capacity expansion methodologies. The effect of load curve uncertainty on capacity planning is considered and the use of a certain expected load curve to account for uncertainty in demand is proposed. How uncertainty influences the allocation of capital costs among the various load curve realizations is also discussed. The supply side uncertainties of fuel prices and random availability of generating units are considered. In certain cases it is shown that the use of the expected fuel costs will furnish a solution which minimizes the total expected costs. The effect of derating units to account for their random availability is also characterized. A stochastic linear program formulated to examine the simultaneous consideration of fuel cost and demand uncertainties is analyzed. This volume includes the report text one appendix with information on linear programming-based analysis of marginal cost pricing in the electric utility industry.

**33391 (GJBX—182(81)) Domestic utility attitudes toward foreign uranium supply.** (Bendix Field Engineering Corp., Grand Junction, CO (USA); Nuclear Resources International, Atlanta, GA (USA)). Jun 1981. Contract AC13-76GJ01664. 38p. NTIS, PC A03/MF A01. Order Number DE81025509.

The current embargo on the enrichment of foreign-origin uranium for use in domestic utilization facilities is scheduled to be removed in 1984. The pending removal of this embargo, complicated by a depressed worldwide market for uranium, has prompted consideration of a new or extended embargo within the US Government. As part of its on-going data collection activities, Nuclear Resources International (NRI) has surveyed 50 domestic utility/utility holding companies (representing 60 lead operator-utilities) on their foreign uranium purchase strategies and intentions. The most recent survey was conducted in early May 1981. A number of qualitative observations were made during the course of the survey. The major observations are: domestic utility views toward foreign uranium purchase are dynamic; all but three utilities had some considered foreign purchase strategy; some utilities have problems with buying foreign uranium from particular countries; an inducement is often required by some utilities to buy foreign uranium; opinions varied among utilities concerning the viability of the domestic uranium industry; and many utilities could have foreign uranium fed through their domestic uranium contracts (indirect purchases). The above observations are expanded in the final section of the report. However, it should be noted that two of the observations are particularly important and should be seriously considered in formulation of foreign uranium import restrictions. These important observations are the dynamic nature of the subject matter and the potentially large and imbalanced effect the indirect purchases could have on utility foreign uranium procurement.

33392 **(ORNL/Sub—80/40416/1) Potential contribution of currently operating nuclear-fueled electric-generating units to reducing US oil consumption.** Koppe, R.H.; Olson, E.A.J.; Van Howe, K.R. (Oak Ridge National Lab., TN (USA); Stoller (S.M.) Corp., New York (USA)). 30 Sep 1980. Contract W-7405-ENG-26. 56p. NTIS, PC A04/MF A01. Order Number DE81030497.

This study examines the prospect for performance improvement in the 62 light water reactors in operation in the US as of the end of last year and which are deemed to have current commercial design features. These units represent a total net capacity of 49,481 MW(e). In the last two years (1978 to 1979), total capacity factor losses for these units was 36.5%. This study finds that in the short-term, capacity factor improvement of about 16% could be achieved, for example, in response to a short-term energy crisis. In the long-term a gain of perhaps 18% could be achieved. Such gains would represent a decrease in equivalent oil consumption of approximately 350,000 barrels a day. In addition, this study evaluated potential increases in the operating power level of these units, and concluded that a short term power level increase of about 2500 MW(e) could be achieved, in addition to a long term increase of about 1700 MW(e). This total short term power level increase would be equivalent to 138,000 barrels of oil per day.

## 2907 Transport And Storage

*REFER ALSO TO CITATION(S) 32907, 32923, 33373*

## 2908 Waste Heat Utilization

*REFER ALSO TO CITATION(S) 32970, 33147, 33252, 33473, 33477, 33478, 33480*

33393 **Institutional obstacles to industrial cogeneration.** Dean, N.L. Jr. pp 167-185 of Selected studies on energy, background papers for energy: the Next Twenty Years, 1980. Landsberg, H.H. (ed.). Cambridge, MA; Ballinger Publ Co (1980).

This paper outlines the institutional barriers hindering cogeneration development in the United States and examines what can be and is being done to overcome those barriers. The first sections of the paper describe the cogeneration concept, its technologies, and its fuel-saving and other advantages. The center section of the paper outlines the many institutional barriers to cogeneration and suggests several approaches for lowering them. The final sections review the ongoing federal and state policy initiatives for encouraging the concept and suggest the need to shift the focus of the present policy debate.

## 2910 Conservation

*REFER ALSO TO CITATION(S) 33444, 33447, 33458, 33459, 33464*

33394 **(DOE/CE—0016) Annual report to the President and the Congress on the State Energy Conservation Program for calendar year 1980.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Jul 1981. 40p. NTIS, PC A03/MF A01. Order Number DE81025862.

The activities of the fifth year's operation (December 1979 through December 1980) of the State Energy Conservation Program are reported. The program requires states to develop and implement plans that will reduce projected energy consumption by 5% or more in 1980. Five program measures required to be eligible for financial assistance under the plan and three program measures under a supplemental plan are described and outlined in Chapter I. The report includes the details of program operation and results to date in Chapter II. Program management is described in Chapter III. Chapter IV is devoted to a description of selected innovative state Program measures. Chapter V is a concluding statement which reflects the President's Program for Economic Recovery. (MCW)

33395 **Study description: an environmental comparison of future urban-transportation alternatives.** Moses, D.; LaBelle, S.J. *Energy Economics, Policy and Management ;* **1**: No. 1, 42-64(Sum 1981).

A technology-assessment project sponsored by the Assistant Secretary for Environment, US Department of Energy will concentrate on the effects of alternative conservation strategies for the efficient movement of people in urban areas. The goals of the project are to provide: a description of several alternative strategies promoting energy conservation in the urban passenger-transportation sector; a better understanding of the environmental impacts of such strategies; and an identification of the constraints to the implementation of such strategies. After a brief discussion of conditions leading to the need for such a project, the process of defining and refining the study is presented. Objectives are then defined via examples followed by a presentation of the project structure and methodology. A short concluding statement presents the status of the major study elements. 7 figures.

33396 **Energy conservation and the rental housing market.** Counihan, R.H.; Nemtzow, D. *Solar Law Reporter ;* **2**: No. 6, 1103-1132(Mar 1981).

Problems unique to the rental housing market are discussed in detail. Market forces have been inadequate to encourage energy conservation because of the split between those who own the buildings and those who use the energy. Renters are unwilling to invest in property they do not own. Owners are unwilling because either (1) tenants pay the energy bills or (2) energy costs can be passed along in the rent. Federal, state, and community legislative efforts in this area are discussed as is the metering problem (master or separate metering). It is concluded that, unless accompanied by financial incentives or standards, a prohibition on master meters is inadvisable. Further involvement by state and local governments is encouraged. 132 references. (MJJ)

33397 **Energy savings from the Minnesota low-income weatherization programme.** Talwar, R. (Mid-American Solar Energy Center, Bloomington, MN); Hirst, E. *Energy Policy ;* **9**: No. 1, 48-51(Mar 1981).

The 26 local Community Action Agencies in Minnesota administer a Federal program to audit and retrofit homes occupied by low-income households. This program aims to improve the thermal performance of these homes and so reduce the economic hardship faced by these households because of high and rising fuel prices. A key question concerns the actual energy savings that can be attributed to the program. The work reported here involved collection and analysis of fuel-consumption records from low-income households throughout Minnesota. Data were obtained from 59 households that had received weatherization services and from 37 households that were eligible for assistance but had not yet been weatherized. Comparisons of fuel consumption across the two groups for the 1976 to 1977 and 1977 to 1978 winters showed that the average saving due to weatherization was 13% of total household energy use. Based on fuel prices that prevailed in 1979, the cost of weatherization is likely to be repaid with lower fuel bills in 3 to 4 years. 24 references, 2 tables.

## 2920 Supply, Demand, And Forecasting

*REFER ALSO TO CITATION(S) 33406, 33414, 33427, 33463*

33398 **(BNL—51330) Analysis of gasoline supply for the United States during the 1979 shortage.** D'Acierno, J.; Beller, M.; Hermelee, A. (Brookhaven National Lab., Upton, NY (USA)). Dec 1980. Contract AC02-76CH00016. 41p. NTIS, PC A03/MF A01. Order Number DE81030195.

This report is a regional level analysis of the supply of gasoline during the gasoline shortage of 1979 with focus on trends in the five components of gasoline supply (refinery production, primary stock withdrawals, pipeline movements, tanker and barge movement, and foreign imports) for each Petroleum Administration for Defence (PAD) District in the United States. The objective is to identify trends in the monthly data for the supply components which can be used to signal the onset of such a shortage in the future. A standard material balance for gasoline is performed for

each PAD District using monthly data before, during, and after the 1979 shortage.

33399 **(LBL—6831-Rev.) Distributed energy systems in California's future: Interim report, Volume I.** Craig, P.; Christensen, M.; Levine, M.D.; MuKamel, D.B.; Simmons, M. (eds.). (Lawrence Berkeley Lab., CA (USA)). Mar 1978. Contract W-7405-ENG-48. 324p. (HCP/P7405—01). NTIS, PC A14/MF A01. Order Number DE81029849.

The objectives of the study are to improve understanding of: (1) the detailed characteristics of possible future energy systems which emphasize decentralization of energy production and distribution; and (2) the externalities, transition difficulties, and implications for public policies that would accompany movement toward such alternative energy outcomes. The study provides a first-cut examination of the relations between energy choices and economics, environmental, and social systems on a local level (California). The study addresses circumstances under which the State of California might become energy self-sufficient by the year 2025, relying entirely on its indigenous renewable resources. The analysis identifies areas where major additional work is needed. (MCW)

33400 **Selected studies on energy; background papers for energy: the Next Twenty Years, 1980.** Landsberg, H.H. (ed.). Cambridge, MA; Ballinger Publ Co (1980). 439p.

This publicationis a collection of 12 background papers for report processed earlier (see EAPA 7:1367). The central message of the report is that energy - expensive today - is likely to be more expensive tomorrow and that society as a whole will gain from a resolute effort to make the price that the user pays for energy, and for saving energy, reflect its true value. All the background papers fall basically into two groups. One deals with largely domestic issues, the other with foreign experience and policies. The subjects cover energy analysis and forecasting of energy demands and resources, the role of price regulations in energy policy, institutional abstracts to industrial cogeneration, the political future of the world oil market, etc. Six of the background papers are indexed separately.

33401 **Our energy world energy in review.** Stewart, O.W. Lexington, Kentucky; University of Kentucky (1981). 15p. (CONF-8104107—8).

From 12. annual Kentucky industrial coal conference; Lexington, KY, USA (29 Apr 1981).

Data are compiled on world recoverable energy reserves (estimates made in 1976) for coal, petroleum, and natural gas. Energy usage data from 1850 to 1978 in the US are tabulated for wood, coal, hydro, oil, gas. Some USA energy market data (by source) for 1975 are given. The dilemmas of petroleum, natural gas, and coal are discussed. The situation of nuclear power and a brief overview on photovoltaic energy, synthetic fuels, solar energy, magnetohydrodynamics, wind power, and fuel cells are included. (MCW)

33402 **Dimensions of energy demand.** Hogan, W.W. (Harvard Univ., Cambridge, Mass). pp 1-92 of Selected studies on energy, background papers for energy: the Next Twenty Years, 1980. Landsberg, H.H. (ed.). Cambridge, MA; Ballinger Publ Co (1980).

Examined are the results of some new studies of the options available for changing the growth in energy demand. This examination suggests that there are substantial opportunities to substitute insulation, new equipment, new production process, or changes in consumption patterns in order to reduce the consumption of energy. The evidence is found in both the examination of specific technologies - for example, the 45% improvement in efficiency now mandated for automobiles - and in the aggregate statistical data, where delivered net energy price elasticities as high as unity imply that a doubling of the delivered price of energy could improve energy efficiency by 50%. In view of the evidence of many opportunities for reducing energy demand, it is not necessary to produce a precise forecast based on a single view of the future.

33403 **Preparing for an oil crisis: elements and obstacles in crisis management.** Krapels, E.N. pp 187-210 of Selected studies on energy, background papers for energy: the Next Twenty Years, 1980. Landsberg, H.H. (ed.). Cambridge, MA; Ballinger Publ Co (1980).

This paper examines several aspects of national oil security programs. First, the emergency petroleum stockpiles of six importing countries - the United States, Japan, West Germany, France, Italy, and the Netherlands - are examined. The difficulties that the United States is having with various facets of its emergency program are briefly discussed.

## 2930 Policy, Legislation, And Regulation

*REFER ALSO TO CITATION(S) 33385, 33400, 33407, 33415, 33420, 33430, 33433, 33434*

## 2940 Fossil Fuels

*REFER ALSO TO CITATION(S) 32865, 32866, 32880, 32881, 32882, 32883, 32884, 32885, 32887, 32923, 32955, 32956, 32957, 32958, 32980, 32981, 32982, 32982, 32983, 32984, 32996, 32998, 33082, 33082, 33382, 33398, 33496*

33404 **(DOE/ET/14356—T1) Effects of ice on coal movement via the inland waterways. Special report 81-13.** Lunardini, V.J.; Minsk, L.D.; Phetteplace, G. (Army Cold Regions Research and Engineering Lab., Hanover, NH (USA)). Jun 1981. Contract AI01-80ET14356. 80p. NTIS, PC A05/MF A01. Order Number DE81029241.

This study examines the problems caused by ice on the movement of coal on the Inland Waterways. The Inland Waterways now carry about 11% of the coal production of the United States. Significant increases in the production, use, and transportation of coal have been projected. The ability of the Inland Waterways to increase its coal handling capacity, especially during the winter has been questioned. That part of the Inland Waterways which carries significant coal and which may experience significant ice problems includes the following rivers or waterways: Ohio, Monongahela, Allegheny, Kanawha, Upper Mississippi, and Illinois. Coal transportation along these rivers may be locally interrupted for periods up to 30 days or more every three to five years. Coal handling facilities, navigation channels, and lock and dam sites along the ice prone rivers were surveyed by visit or telephone to ascertain the scope of the ice problems. Coal moves through any part of the waterways system as a series flow from the coal loading/unloading facilities, along the navigation channels and through the locks to its destination. The importance of ice as a barrier to increased coal movement on the waterways studied manifests itself differently for each link of the flow system. In order of importance the ice will affect the navigation channels, locks and dams, and finally the coal loading/unloading facilities. The coal handling facilities will not be significantly slowed down by ice problems associated with winter navigation. Only rarely is a coal handling facility stopped by ice when the locks and dams or navigation channels are operating normally. The major exception may be the rail car to barge loading link which can cause slowdowns due to coal freezing in the rail cars.

33405 **(DOE/ET/15078—T9) Sensitivity analysis of project appraisal variables. Volume II. Additional variables and composite scenarios.** (Sante Fe Corp., Alexandria, VA (USA)). 31 Jul 1979. Contract AC03-77ET15078. 54p. NTIS, PC A04/MF A01. Order Number DE81018491.

This report is the second of a two-volume documentation of sensitivity analysis of project appraisal variables. The variables analyzed consist of various direct and indirect inputs to the project appraisal methodology (PAM) used by the Division of Fossil Fuel Utilization within the US Department of Energy (DOE) for annual assessment of its research and development projects. In 1979, sixteen division projects were assessed using PAM. Nine input variables were selected for analysis following the 1979 application of the methodology. Six of these inputs were considered to be key variables and are analyzed in Volume I of this report. The remaining inputs were termed additional variables and are reported on in this second volume. The additional variables are: market potential/rate

of growth; market score rates; and energy benefits weights and types. The sensitivity analysis results indicate that changes in additional variables do not effect major changes with the exception of the no growth market potential scenario. The results of this study indicate that the PAM is relatively insensitive to small changes in input values. This confirms the validity fo PAMs structure.

33406 (EPRI-WS—79-182, pp 3.1.1-3.1.19) **World oil prices.** Blankenship, J. (Dept. of Energy, Washington, DC); Gaskins, D.W. Jr. Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

The impact on the US economy of increases in the world price of petroleum is the primary motivation for a national energy policy. Any economic analysis of domestic energy policy must, therefore, begin with projections of the future pricing and production plans of the major producers of oil on the world market. Forecasting the price of any commodity, and oil in particular, over any significant period of time entails a great deal of uncertainty. The purpose of this paper is to discuss the various sources of uncertainty in the future price of oil and to present some oil price trajectories resulting from different assumptions about several major determinants of those prices. Uncertainty over the price of oil arises from three primary sources: OPEC behavior; world oil resources; and future demand. Each of the three major determinants of future oil prices mentioned above are considered in detail. One or more models of the world petroleum market are used to examine experimentally the implications for future oil prices of different underlying assumptions regarding OPEC behavior, oil resources, and future demand.

33407 (EPRI-WS—79-182, pp 3.2.1-3.2.7) **Prospects for diversifying sources of imported oil and gas supplies.** Despres, G. Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

How to reduce the political and economic vulnerability of the US to disruption in oil supplies is discussed. The current question for energy policy is what, if anything, should the United States do to facilitate the development of such diverse and uncertain petroleum resources. Exploring for oil and gas is an inherently speculative venture that seems to have been unduly impeded by political, legal, and fiscal changes in the investment rules. Most producing countries now aggressively assert national sovereignty over their natural resources. Widespread adherence to the doctrine of changed circumstances has largely eroded the role of contracts in guaranteeing the terms and conditions under which foreign enterprises operate. Finally, uncertainty over host country tax rates and the interplay between foreign and domestic tax systems increase the difficulty of assuring an adequate return on investment. To improve the prospects for increased investment outside the Persian Gulf, the United States and its allies need a regime for securing more liberal and reliable terms for their investors. This regime would utilize a combination of loans and political and commercial risk insurance. Direct financing is likely to be important for developing the vast gas potential that exists outside the United States and OPEC. Prospects for oil and gas diversification could also be improved by independent US action, including: technical assistance; preferential price, tariff and tax treatment for non-Persian Gulf supplies; long-term contracts and market guarantees, particularly in the case of heavy oils; and removal of existing restrictions on private and public investment. In addition, the Government has unique responsibility for improving political relations with non-OPEC oil producing nations, such as Mexico.

33408 (EPRI-WS—79-182, pp 3.4.1-3.4.18) **Impact of economic and demographic growth on oil and gas availability from less developed countries.** Shaikh, A.M. (Energy/Development International, Washington, DC). Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

This paper addresses the following hypothesis: for a Less Developed Country (LDC) with proven, commercially recoverable oil and gas resources, the country's economic and demographic structure will be an important determinant of the availability to international markets of those resources. There are two channels through which the international availability of a country's energy resources can be affected. First, through the determination of the rate of production, assuming that some choice of a production/reserve (P/R) ratio exists; second, through the allocation of production between domestic consumption and export.

33409 (EPRI-WS—79-182, pp 3.5.1-3.5.5) **Rent-skimmers, techniques for risk minimization, and impact on incentives.** Stauffer, T. (Harvard Univ., Cambridge, MA). Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

This discussion covers (a) recent developments in the taxation of oil by producing governments; and (b) some issues in the taxation of overseas oil operations by countries of domicile. For any mineral-producing host country, greed is the fundamental leitmotif of any taxing authority. For host countries that are not yet producing or exporting oil, there has been a new development deriving from practices in the United Kingdom, Canada, and Norway: the concept of profitability-taxation as distinct from profit-taxation, through taxes which are sometimes called rent-skimmers by analogy with the cream skimmer. These rent-skimmer taxes, which are based upon a reference rate of return, provide flexibility against unforeseen price changes, and against the unknowability of costs. The mechanics of these taxes are relatively straightforward, once an answer has been provided to the policy question, What constitutes a fair rate of return.

33410 (EPRI-WS—79-182, pp 3.6.1-3.6.13) **Effect of the prospective investment climate on future oil and gas supplies from foreign sources.** Leveson, S.M. (Leveson Associates, Marlboro, NJ). Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

The World Bank has made great progress towards encouraging petroleum exploration in less developed countries (LDC). Further progress will depend upon: (1) Dealing with host country perceptions that terms offered by multinational oil companies require the countries to pay for unsuccessful exploration elsewhere; and, (2) Incorporating into LDC exploration decisions the benefits to industrialized countries from influencing oil prices and security of supply. A program is proposed of exploration subsidies designed to address both of these considerations. The program could enhance world oil supplies by 1 million barrels per day (MBD) by the early 1990s and perhaps 3-4 MBD by the year 2000.

33411 (EPRI-WS—79-182, pp 3.7.1-3.7.3) **Contracts or concessions for exploration and production.** Nadeau, C.E. (Hoover, Cox and Shearer, Houston, TX). Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

This discussion is limited to contracts or concessions for the exploration and production of natural resources where the contractor or concessionaire is an American or other foreign entity - probably a multinational enterprise. Experience shows that in the event of a dispute or nationalization, an arbitration provision in the contract or concession may provide a usable remedy. Unless there has been a waiver of sovereign immunity, the sovereign is probably not required to recognize arbitration. To be effective, the waiver must be based on a legislative act. This act may be in a law, or in a convention or by legislative approval of the contract. Research indicates that this doctrine even applies to countries that are ordinarily viewed as dictatorships. While in the past such provisions seem to have been routinely included in contracts or concessions, two situations exist in which countries have adamantly refused to include an arbitration provision in an exploration contract. Since the Third World has good communications, this may represent a new trend in contract negotiations.

**33412** (EPRI-WS—79-182, pp 3.8.1-3.8.4) **Politics of oil and gas.** Conant, M.A. (Conant Associates, Washington, DC). Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

The history of oil politics is related. The place of the political analyst in forecasting in the oil industry is described. The need to create an import security profile whereby all points are considered which could affect investment is discussed. Iran is an example where, if a political analyst had provided input, a more reliable forecast would have resulted. (DMC)

**33413** (EPRI-WS—79-182, pp 3.9.1-3.9.15) **World oil and gas reserves.** Grenon, M. (International Inst. for Applied Systems Analysis, Laxenburg, Austria). Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

To achieve a better understanding of the available global or regional oil and gas resource assessments, it is worthwhile to analyze the true differences between reserves and resources: their time horizon, their economic prospects, who made the assessment, why, and how. This approach helps to reveal the fact that interest in resources has been much weaker and less productive of good assessments than has interest in reserves. However, for any long-term energy policy considerations (say, up to the year 2000 or beyond), resources are much more important than reserves. With these factors in view, this presentation reviews the two dozen estimates of world oil resources performed since the end of World War II. The important question, after one has analyzed the numbers, is: Is there any consensus of world experts on a figure such as, for instance, the often-quoted one of 2000 billion barrels, for ultimately recoverable oil resources. The IIASA study has shown that only a few of the estimates are really independent and has traced the lines of descent that the derivative estimates have followed. Special attention was devoted to the 1977 Delphi study performed for the Conservation Commission of the World Energy Conference, to which almost 30 world oil experts contributed. One conclusion which may be drawn is that, for the time being, the so-called consensus is not really scientifically founded. In particular, some apparent convergence of opinion on the accepted value of $2000 \times 10^9$ barrels is not supported by any similar agreement on regional distribution, concerning which the higher and lower estimates may differ by a factor as great as 6. As a result, it is concluded that much remains to be done to improve the situation regarding a badly needed new assessment of world oil resources.

**33414** (EPRI-WS—79-182, pp 3.10.1-3.10.16) **World oil resource estimates: differences and difficulties.** Attanasi, E.D.; Root, D.H. (Geological Survey, Reston, VA). Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

A discussion is presented on factors determining oil production and forecasts are made on oil production and resource estimates. The author concludes that world petroleum production will peak and begin to decline long before petroleum resources are exhausted. Even perfect knowledge of the amount of petroleum that will ultimately be produced, including that from as-yet-undiscovered fields, would give only the vaguest idea of when production will peak. When US production peaked in 1970, probably about half the petroleum had been produced; of course, even though this peaking took place 10 years ago, ultimate production is still an unknown quantity. The difficulty in determining the peak date is substantially increased if in addition to oil, tar sands, oil shale, and coal are considered. Conventional economic indicators, such as price and current and historical production costs, will not provide reliable warning of approaching scarcity, because domestic and world markets have been distorted by government intervention, which makes interpretation of price changes more uncertain than if the markets were free. Moreover, markets are shortsighted. The long lifespan of capital equipment means that adjustments to declining petroleum production will be slow. This inability to adjust rapidly means that industry requires a longer warning than markets can be relied upon to give. Trends in discovery rates provide a superior measure upon which to base production forecasts. Two discernible trends confirm the fact that the discovery rate for the non-communist world outside the United States and Canada has declined. First, political and economic powers are concentrating around oil fields. Second, exploration worldwide is moving into offshore areas and arctic regions, environments where the costs of operation have previously been prohibitive.

**33415** (EPRI-WS—79-182, pp 3.14.1-3.14.7) **Perspective on individual regions: the Middle East.** Springborg, R. (Univ. of Pennsylvania, Philadelphia). Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

US relations to nations of the Middle East are evaluated in this article. The author indicates that rather than developing an overall strategy, the US has been using survival tactics and coping with each event as it arises. Strains in US relations with Saudi Arabia are cited. The Eyptian-Israeli peace agreement is also discussed.

**33416** (EPRI-WS—79-182, pp 3.15.1-3.15.14) **Comments on oil and gas reserves in Mexico.** Woodside, P.R. Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

Based on an evaluation of all available published and unpublished reserve and resource estimates as of June 13, 1979, the remaining reserves, undiscovered resources, and maximum attainable oil production in Mexico are presented. A comparison of Mexican oil and gas reserves with those of other selected producing countries shows that Mexican petroleum will have a significant impact on world hydrocarbon availability. As the Reforma and Campeche are the deepest major oil provinces in the world, and considering industry experience with thick reservoirs such as are found here, production rates and production methods will determine how much of the proved and probable reserves will ultimately be recovered.

**33417** (EPRI-WS—79-182, pp 3.16.1-3.16.10) **Mexico's oil and gas: a realistic perspective.** Pagliano, G.J. Aug 1981. NTIS, PC A13/MF A01. Order Number DE81904250.

From Workshop on world oil and natural gas supplies; Reston, VA, USA (12 Jun 1979).

This paper explores the production of oil and gas in Mexico during the 1980's and the impact that this production will have on Mexico, both domestically and internationally. Discussed are: Mexico's production capability; Mexico's demand for oil and gas; export potential; oil and gas revenues; unemployment; agriculture; inflation; and US relations. (DMC)

## 2950 Hydrogen And Synthetic Fuels

*REFER ALSO TO CITATION(S) 32984*

**33418** **Appendix.** *Cameron Synthetic Fuels Report ;* **18**: No. 1, 5.1-5.48(Mar 1981).

To accelerate development of this new industry, the United States Synthetic Fuels Corporation was established by Congress. The Corporation will act like a private financial institution, providing financial incentives to the private sector for the construction and operation of commercial-scale plants producing synthetic fuel substitutes for imported oil. The importance of a synthetic fuels program is set forth in the Energy Security Act. The powers of the Corporation are delineated in the Energy Security Act. The powers of the Corporation are exercised by a seven-member Board of Directors appointed by the President, subject to Senate confirmation, for seven-year staggered terms. The Corporation will be a small, lean organization with a highly competent professional staff recruited primarily from the private sector. The Act provides the Corporation up to $20 billion of initial obligational authority in an Energy Security Reserve established in the Department of the Treasury. The Energy Security Act authorizes the Corporation to borrow funds from the Energy Security Reserve for specific purposes enumerated in the Act. The Corporation is intended to serve as a catalyst in creating a private-sector synthetic fuel industry in the United States.

## 2960 Electric Power

*REFER ALSO TO CITATION(S) 33089, 33264, 33461*

**33419 (DOE/EIA/10612—T26-Apps.B-C) Evaluating the role of uncertainty in electric utility capacity planning (Appendices B and C).** Soyster, A.L. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). 31 Aug 1981. Contract AC01-80EI10612. 171p. NTIS, PC A08/MF A01. Order Number DE81029288.

This final report on Evaluating the Role of Uncertainty in Electric Utility Capacity Planning is divided into separate sections addressing demand, supply and the simultaneous consideration of both and describes several mathematical characterizations of the effects of uncertainty on the capacity expansion decision. The basic objective is to develop more robust models which can appropriately include the fundamental uncertainties associated with capacity expansion planning in the electric utility industry. Much of what has been developed in this project has been incorporated into a long-term, computer model for capacity expansion planning. A review is provided of certain deterministic capacity expansion methodologies. The effect of load curve uncertainty on capacity planning is considered and the use of a certain expected load curve to account for uncertainty in demand is proposed. How uncertainty influences the allocation of capital costs among the various load curve realizations is also discussed. The supply side uncertainties of fuel prices and random availability of generating units are considered. In certain cases it is shown that the use of the expected fuel costs will furnish a solution which minimizes the total expected costs. The effect of derating units to account for their random availability is also characterized. A stochastic linear program formulated to examine the simultaneous consideration of fuel cost and demand uncertainties is analyzed. This volume contains two appendices, one on the mathematical theory for the nonhomogeneous capacity expansion algorithm and the second on computer implementation of the utility capacity expansion model.

**33420 (EMD—81-50) Federal electrical-emergency preparedness is inadequate.** (General Accounting Office, Washington, DC (USA)). 12 May 1981. 50p. General Accounting Office, Gaithersburg, MD. Order Number DE81904050.

Report to the Congress by the Comptroller General of the United States.

If saboteurs, terrorists, or an enemy attacked the nation's electric power system, would the Federal Government be prepared to handle the resulting energy disruptions? Probably not, because the Department of Energy has failed to prepare required electric emergency preparedness plans. A national plan to cope with the problems caused by a loss of electricity - which would virtually halt communication, transportation, and distribution systems - is essential, because utilities and the states cannot be expected to deal with such emergencies on their own. The Department of Energy should work with the utility industry, the states, and the Federal Emergency Management Agency to develop and maintain detailed electrical emergency plans.

**33421 (EPRI-EA—1672(Vol.2)) Regional load-curve models: QUERI's model specification, estimation and validation. Final report.** Ramanathan, R.; Engle, R.F.; Granger, C.W.J. (Quantitative Economic Research, Inc., San Diego, CA (USA)). Aug 1981. 117p. NTIS, PC A06/MF A01. Order Number DE81904252.

The objective of this project is to construct a model that relates the hourly demand for electricity in a given region to the short-run characteristics such as weather at specific hours of a day, and long-run attributes such as changes in income, population, appliance stock, and industrial mix. A two-step model or electricity demand was estimated using hourly load data for 32 regions for the period 1962 to 1974 and data on a number of region specific variables such as the ones listed above. The first stage related hourly demand in each region to weather and other time-of-day (TOD) variables. The set of parameters obtained from this stage were then related to the longer run variables stated above. Both by measures of goodness of fit and by statistical significance of the estimated parameters, the results may be deemed quite successful. The model highlights the importance or economic and demographic variables in long-run load forecasting. A post-sample validation of the model was also carried out using the data for the period 1975 to 1977 for six test regions representing a variety of climatic conditions and socio-economic characteristics. For five of the six regions, the model had an average forecast error of 4.5% (in one region, a correction had to be made for non-reporting by an individual utility). For the sixth region, the error was 15%. Differences in growth rates of explanatory variables between the periods 1970 to 1974 and 1975 to 1977 account for 5% with 10% unaccounted for. On the whole, the model is robust and captures the load shapes quite well. The predicted peak was usually within ten percent of the actual peak and mostly below. With minimal data requirements QUERI's model may be adopted to generate forecasts for a sub-regional area such as a utility service are. This report outlines a method to achieve this. However, further work is necessary to examine how well it will succeed.

**33422 (EPRI-EA—1672(Vol.3)) Regional load-curve models: scenario and forecast using the DRI model. Final report.** Platt, H.D. (Data Resources, Inc., Lexington, MA (USA)). Aug 1981. 283p. NTIS, PC A13/MF A01. Order Number DE81904192.

Regional load curve models were constructed for 32 regions that have been created by aggregating hourly load data from 146 electric utilities. These utilities supply approximately 95% of the electricity consumed in the continental US. The 32 models forecast electricity demands by hour, 8784 regional load forecasts per year. Because projections are made for each hour in the year, contemporaneous forecasts are available for peak demands, megawatt hour demands, load factors, load duration curves, and typical load shapes. The forecast scenario is described and documented in this volume and the forecast resulting from the use of this scenario is presented. The highlights of this forecast are two observations: (1) peak demands will once again become winter phenomena. By the year 2000, 18 of the 32 regions peak in a winter month as compared with the 8 winter peaking regions in 1977. In the heating season, the model is responsive to the number of heating degree-hours, the penetration rate of electric heating equipment, and the rate at which this space conditioning equipment is utilized, which itself is functionally dependent on the level of real electricity prices and real incomes. Thus, as the penetration rate of electric heating equipment increases, winter season demands grow more rapidly than demands in other seasons and peaks begin to appear in winter months; and (2) load factors begin to increase in the forecast, reversing the trend which began in the early 1960s. Nationally, load factors do not leap upwards, instead they increase gradually from .609 in 1977 to .629 in the year 2000. The improvement is more consequential in some regions, with load factors increasing, at times, by .10 or more. In some regions, load factors continue to decline.

**33423 (EPRI-EA—1807) Generation planning system: methodology and case study. Final report.** Hakki, A.; Schoor, A. (Gordian Associates, Inc., Hackensack, NJ (USA)). Aug 1981. 350p. NTIS, PC A15/MF A01. Order Number DE81904191.

This report for RP950 describes the approach used to develop a generation planning model and illustrates its potential application with a case study performed on a synthetic utility. The model is an optimization model that provides a simultaneous solution for the entire time span of the expansion rather than for each year individually. It is based on linear programming techniques. Since several important utility factors are nonlinear in nature, special techniques are used to approximate these nonlinear functions in linear form. To verify these approximations an additional model, which is described briefly in this report, is appended to the optimization model to recalculate the reliability levels and production costs of the selected expansion plan. A subprogram of the optimization model calculates loss-of-load probability for expansion patterns with various combinations of candidate generating units. This information is used in a regression analysis to determine reserve-margin requirements associated with the addition of each type of generating unit, and the regression equation is incorporated into the linear program. Details of this technique are demonstrated with the description of a complete case study.

**33424 (EPRI-EA—1964(Vol.1)) Evaluating R and D options under uncertainty. Volume 1. Pulverized-coal development strategies. Final report.** Borison, A.B.; Judd, B.R.; Morris, P.A.; Walters, E.C. (Applied Decision Analysis, Inc., Menlo Park, CA (USA)). Aug 1981. 73p. NTIS, PC A04/MF A01. Order Number DE81904241.

A quantitative framework was developed for examining the appropriate emphasis for research funding aimed at improving electrical power generation technologies. The methodology explicitly considers the multiple objectives of research, the uncertainty in research outcomes, and the market use of an improved technology in the context of other competitive power generation technologies. The methodology was applied in EPRI's Coal Combustion Systems (CCS) Division to the current pulverized coal technology. The application addressed the relative advantages and overall benefits of incremental funding in three general research areas: capital cost, reliability, and performance. The analysis concludes that the benefits of incremental funding in the capital cost area appear to dominate the benefits in the reliability and performance areas. Furthermore, the net expected value of incremental pulverized coal research funding is high. These results are demonstrated to hold over a wide range of assumptions.

**33425 (EPRI-EA—1964-Vol.2) Evaluating R and D options under uncertainty. Volume 2. Atmospheric fluidized-bed combustion commercialization strategies. Final report.** Borison, A.B.; Judd, B.R.; Morris, P.A.; Walters, E.C. (Applied Decision Analysis, Inc., Menlo Park, CA (USA)). Aug 1981. 79p. NTIS, PC A05/MF A01. Order Number DE81904246.

This study developed and demonstrated a quantitative framework for analyzing commercialization decisions for emerging electrical power generation technologies. The framework addresses the general question of when to freeze a design for commercialization. The framework was developed to help evaluate the benefits of continuing the development of two different designs for atmospheric fluidized-bed combustion (AFBC) boilers. EPRI staff participated actively in specifying the scope of the analysis and in providing technical information on the two designs. The framework was demonstrated using this information, supplemented with probabilistic judgments by EPRI staff about possible outcomes from the pilot and demonstration stages of development. Based on the technical data and judgments supplied by EPRI staff, the analysis shows a net benefit for proceeding with the development of two designs. Extensive sensitivity analysis shows this result holds over a broad range of input data. The insight behind this result is the value of using a second design as a hedge against an unfavorable outcome with the first design. The degree to which other power generation technologies could serve as a hedge for a single AFBC design was not considered explicitly in the analysis.

**33426 (EPRI-EA—1964(Vol.3)) Evaluating R and D options under uncertainty. Volume 3. An electric-utility generation-expansion planning model. Final report.** Borison, A.B.; Judd, B.R.; Morris, P.A.; Walters, E.C. (Applied Decision Analysis, Inc., Menlo Park, CA (USA)). Aug 1981. 114p. NTIS, PC A06/MF A01. Order Number DE81904237.

This report describes an electric utility generation expansion model developed for use in research and development (R and D) planning under uncertainty. The model provides a framework for examining broad utility and R and D planning issues, rather than the specific generation expansion decisions of individual utilities. Unlike existing approaches, the model focuses directly on the demand, technological, and regulatory uncertainties and the long-term dynamics that affect the impact of R and D achievements. The model's somewhat aggregate approach to electric utility decision-making (to allow repeated application at low cost) can be modified, as needed, for more detailed utility planning. When fully implemented, the model can be applied to the analysis of issues such as technology adoption, reserve margin, unit size, reliability, storage and load management effects, lead time, and government regulation. The model inputs include demand, supply (generation technology characteristics), and external factors (regulatory constraints). The outputs are the optimal (minimum discounted expected cost) generation expansion plan, its cost, and other aspects of this plan. The model relies on three mathematical programming approaches: dynamic programming, iterative dynamic programming, and state-of-the-world decomposition. The state-of-the-world decomposition component separates the main problem into a set of individual scenario problems, each of which is solved with the iterative dynamic-programming component. The iterative dynamic-programming component, in turn, transforms each individual scenario problem into a series of even simpler problems, each of which is solved with the dynamic-programming component. Possible future extensions of the model involve increased operating detail, increased financial detail, explicit incorporation of storage and load management options, and more efficient treatment of closed-loop decision-making.

**33427 (ORNL/TM—7863) ORNL rural electric-energy-demand forecasting model.** Maddigan, R.J.; Chern, W.S.; Gallagher, C.A.; Holcomb, B.D.; Cobbs, J.C. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 175p. NTIS, PC A08/MF A01. Order Number DE81030696.

The development of a forecasting model of annual electrical-energy sales for the Rural Electrification Administration (REA) borrowers is discussed. The Oak Ridge National Laboratory, Rural Electric Energy Demand (ORNL-REED) model highlights the unique features of rural electricity demand by empirically examining the customers of the electric cooperatives. The model is used to forecast annual electricity sales by state and sector for the next twenty years. REED is a nonlinear, simultaneous-equation econometric model. It consists of submodels for the residential, commercial, industrial and irrigation sectors. The construction of a data base which reflects the cooperatives' service areas is described. The nine structural equations of REED were estimated using pooled, cross-section, time-series data for the period 1969 through 1977 for five regions. In general, the residential and commercial own-price demand elasticities are lower for the rural cooperatives than they are for the rest of the electric utility industry. However, the elasticities estimated by REED for the industrial sector tend to be higher than those estimated for the total state. The price elasticities of demand for irrigation are greater than the other sectors, indicating that the farmer is especially sensitive to changing electricity prices. The forecasts of the cooperatives' electricity demand are estimated for six sets of input assumptions, These projections give a range of total demand growth between 5.4% and 6.6% depending upon the demographic and fuel-price assumptions, compared to the 9.8% growth the cooperatives experienced between 1969 and 1977. The projected growth figures vary across states and sectors.

**33428 New perspectives on public power.** Radin, A. Washington, DC; American Public Power Association (1981). 14p. (CONF-8105108—1).

From Annual meeting of the Tennessee Valley Public Power Association; Nashville, TN, USA (5 May 1981).

Some of the far-reaching changes which have recently taken place in the electric utility industry and their effects on the future of electric utilities are discussed. These changes include escalating cost of new generating facilities; share of utilities costs attributable to interest payments; slow-down in load growth; and electric rates rising faster than cost-of-living. The impact of these economic factors on the residential and industrial power consumer, and services utilities can provide to promote wise use of electric power reliably and economically are discussed. (LCL)

**33429 Electric utilities face the next twenty years.** Stelzer, I.M. (National Economic Research Associates Inc., NY). pp 127-144 of Selected studies on energy, background papers for energy: the Next Twenty Years, 1980. Landsberg, H.H. (ed.). Cambridge, MA; Ballinger Publ Co (1980).

This paper discusses two broad types of problems that the electric-utility industry faces in the next twenty years: those particular to the industry and those arising for the industry from general issues society is having difficulty resolving. The three most important particular problems facing the electric utilities are earnings, rates, and the need to recuperate from self-inflicted wounds. Among the general problems three are discussed, namely: the no-growth controversy, nuclear policy, and federal-state relationships.

33430 **Price regulation and energy policy.** Mause, P. pp 145-166 of Selected studies on energy, background papers for energy: the Next Twenty Years, 1980. Landsberg, H.H. (ed.). Cambridge, MA; Ballinger Publ Co (1980).

Explained is utility regulation and its peculiar impact upon supply and demand, such an understanding being vital to any analysis of energy policy in the United States. Provided are some examples of the effects that utility regulation has on energy management, and some policy measures are reivewed that would increase the efficiency of energy policy. It is concluded that, in general, the gap between marginal costs and current prices may be politically impossible to close. Instead, a combination of efforts to revise rate structure to provide more accurate price signals to consumers and various regulatory measures will probably have to be undertaken. Active utility involvement in energy conservation and alternative-energy-supply investments, appliance efficiency standards, building standards, and mandatory industrial efficiency standards may all be necessary to ensure that those conservation investments which are less costly than new supply will actually be made.

33431 **Energy management programs for commercial & industrial customers: panel presentation.** Washington, DC; American Public Power Association (1980). 8p. (CONF-8009170—4).

From American Public Power Association energy management and communications workshop; Myrtle Beach, SC, USA (30 Sep 1980).

A detailed methodology for developing a positive relationship with rate paying customers is presented with hints on how to get acceptance of necessary rate increases. The method hinges on timing, honestly, friendliness and total information package. (PSB)

### 2980 Consumption And Utilization

*REFER ALSO TO CITATION(S) 33449, 33460, 33464*

### 2990 Unconventional Sources And Power Generation

*REFER ALSO TO CITATION(S) 32984, 33090, 33090, 33092, 33097, 33098, 33102, 33103, 33104, 33114, 33129, 33130, 33131, 33140, 33147, 33159, 33161, 33167, 33175, 33176, 33177, 33179, 33182, 33183, 33184, 33189, 33190, 33233, 33475, 33761*

33432 **(CONF-7910232—) Proceedings of the Pacific Northwest alternative and renewable energy resources conference.** (USDOE Bonneville Power Administration, Portland, OR). 1979. 45p. NTIS, PC A03/MF A01.

From 1. annual pacific northwest alternative and renewable energy resources conference; Seattle, WA, USA (15 Oct 1979).

The purpose of the proceedings is to solicit regional cooperation in promoting the near-term development of such energy sources as cogeneration, biomass, small hydro, solar end-use applications, geothermal direct heat utilization; and wind. Six panel discussions covered the following: sources which are commercially viable; institutional factors - incentives and constraints; institutional factors - roles and responsibilities; planning the development of energy resources; the economics and costs involved; and actual experiences in the development of alternative and renewable energy resources. (MCW)

33433 **Wind Energy Systems Act of 1980.** Washington, DC; Committee of Conference (1980). 17p. Avail: US Capitol, House Document Room.

A compromise set of findings and purpose was adopted which is based on parts of both the House and Senate bills. By the end of 1988, the Act seeks (1) to reduce the average cost of electricity produced by installed wind energy systems (2) to reach a total megawatt capacity in the U.S. from wind energy systems of at least 800 megawatts, of which at least 100 megawatts are provided by small wind energy systems and (3) to accelerate the growth of a commerically viable and competitive industry to make wind energy systems available to the general public as an option. It is recommended that the House recede from disagreement to the Senate amendment to test the bill and agree on a compromise title.

33434 **PURPA and PV systems.** Eisenstadt, M.M. (Mel Eisenstadt & Associates, Inc., Albuquerque, NM). *Solar Law Reporter ;* **2**: No. 6, 1061-1082(Mar 1981).

The Public Utility Regulatory Policies Act of 1978 (PURPA) which encourages the decentralized generation of electricity by cogeneration and from renewable energy sources is reviewed. The profound effect of PURPA on small power production facilities (QFs) such as small residential or commercial installations equipped with photovoltaic (PV) systems is discussed. It is concluded that PURPA's provisions for utility interconnection and power purchases at advantageous rates are likely to influence the design of PV systems, encouraging battery storage of electricity and promoting an orientation of PV arrays to produce the maximum economic value, rather than the maximum production of electricity. Recommendations are made for economic studies to determine the effect of PURPA on PV systems, both with and without storage capacity. 49 references. (MJJ)

## 30 DIRECT ENERGY CONVERSION

### 3001 Mhd Generators

*REFER ALSO TO CITATION(S) 33268*

33435 **(DOE/NASA/0051—2) Conceptual design study of potential early commercial MHD powerplant. Final report of Task 2 results.** Hals, F.A. (Avco-Everett Research Lab., Inc., Everett, MA (USA)). Mar 1981. Contract AI01-77ET10769. 256p. (NASA/CR—165235). NTIS, PC A12/MF A01. Order Number DE81030882.

The first phase (Task I) of the program consisted of parametric analysis of three different reference power plants. This second phase (Task II) consisted of the conceptual design of one of the reference plants analyzed in Task I. This power plant was identified as attractive and selected for further study in Task II on the basic of Task I results. It employs oxygen enrichment of the combustion air and preheating of this oxygen enriched air to an intermediate temperature of 1200°F attainable with a tubular type recuperative heat exchanger. The plant has a nominal plant capacity of 950 MW/sub e/. Conceptual designs of plant components and equipment with performance, operational characteristics and costs are reported. Plant economics and overall performance including full and part load operation are reviewed. Performance analysis showed that a net plant efficiency of 43.9% is attained at nominal load. The projected performance and estimated costs of this early MHD plant are shown to be attractive compared to conventional power plants, although it does not offer the same high efficiency and low cost as the mature MHD power plant considered in ECAS. Environmental aspects and the methods incorporated in plant design for emission control of sulfur and nitrogen are reviewed. Results from reliability/availability analysis conducted are also included.

33436 **Thermal performance analysis of an MHD simulation test facility.** Kumar, R.A.; Powe, R.E.; Steele, W.G. Jr. (Miss State Univ, Mississippi State). *American Society of Mechanical Engineers, [Paper] ;* No. 80-WA/HT-13, vp(1980).

To evaluate the performance of the downstream components of a coal-fired, baseline, open cycle MHD power plant, Mississippi State University has set up a simulation test facility. Reduced thermal data from this test stand for steady-state operating conditions are presented in the paper. A thermal model to predict the variation of important thermal parameters in the test stand is shown. Results from the reduced experimental data and the predictive thermal model are compared. In addition, results for calibration runs and from recent secondary combustion tests are discussed. 7 refs.

33437 **On heat balance in coal-fired MHD systems, channel heat transfer and electrode temperature distribution.** Roy, G.D.; Crawford, L.W. (Univ of Tenn, Tullahoma). *American Society of Mechanical Engineers, [Paper] ;* No. 80-WA/HT-11, vp(1980).

This paper presents results from heat transfer studies performed in 7.5 MW/sub t/ and 15 MW/sub t/ direct coal-fired magnetohydrodynamic systems for electrical power generation.

Heat transfer from the various components is measured to determine system heat balance and the influence of parameters related to coal combustion on heat transfer. Measured heat flux from electrode walls is compared with a quasi one-dimensional model and extended for off-design operation. The heat flux values are used in a computer model to evaluate temperature distribution in electrode frames and caps and are compared with measurements taken during power runs. 9 refs.

## 3003 Thermoelectric Generators

*REFER ALSO TO CITATION(S) 33562*

## 3004 Thermionic Converters

33438 **(DOE/NASA/1062—9) Program-management plan with critical-path definition for combustion augmentation with thermionic energy conversion (CATEC).** Morris, J.F.; Merrill, O.S.; Reddy, H.K. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Department of Energy, Washington, DC (USA); Aerospace Corp., Los Angeles, CA (USA)). 1981. Contract AI01-77ET13111. 48p. (NASA-TM—82670; CONF-810527—7). NTIS, PC A03/MF A01. Order Number DE81030432.

From International conference on plasma science; Sante Fe, NM, USA (18 May 1981).

Thermionic energy conversion (TEC) deserves consideration for topping any conversion or process system that receives heat from an energy source at much higher temperatures: in recent TEC-topping analyses, overall plant efficiency (OPE) and cost of electricity (COE) improve slightly with current capabilities and substantially with fully matured technologies. And enhanced credibility derives from proven hot-corrosion protection for TEC by silicon-carbide clads in fossil-fuel combustion products. Combustion augmentation with TEC (CATEC) affords minimal cost and plant perturbation, but with smaller OPE and COE improvements than more conventional topping applications. However risk minimization as well as comparative simplicity and convenience favor CATEC for early market penetration. Therefore a program-management plan is apropos. That plan, its inputs, characteristics, outputs and capabilities are reported.

## 3005 Fuel Cells

33439 **(DOE/NASA/0161—7) Cell-module & fuel-conditioner development. 6th quarterly report, January-March 1981.** Hoover, D.Q. Jr. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). Apr 1981. Contract AI01-80ET17088. 105p. (NASA-CR—165191). NTIS, PC A06/MF A01. Order Number DE81030874.

Progress on the second Phase of a six Phase program to develop commercially viable on-site integrated energy systems (OS/IES) using phosphoric acid fuel cell (PAFC) modules to convert fuel to electricity is reported. Phase II is a planned two year effort to develop appropriate fuel cell module and fuel conditioner conceptual designs. The fuel cell module development effort comprises three coordinated tasks: (1) design of large cell stacks, (2) stack fabrication, and (3) stack testing. The work accomplished during this reporting period is described at the subtask level in detail. (WHK)

33440 **(DOE/NASA/0176—81/2) Preparation and evaluation of advanced electrocatalysts for phosphoric acid fuel cells. Sixth quarterly report, April-June 1981.** Stonehart, P.; Baris, J.; Hochmuth, J.; Pagliaro, P. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Stonehart Associates, Inc., Madison, CT (USA)). 30 Jun 1981. Contract AI01-80ET17088. 27p. NTIS, PC A03/MF A01. Order Number DE81030345.

Utilizing the most recent advances for carbon supports (Consel IV) developed in our parallel EPRI 1200-2 program, the highest performance fuel cell cathode electrocatalyst combination ever observed gives 755 mV vs hydrogen at 100 ASF on air at 180°C and shows a potential improvement to 775 mV vs hydrogen for better electrode structures. A pressurized fuel cell (UTC at 5 atm) would then give 805 mV at 320 ASF and 180°C. Another activity diagnostic is the performance of this electrocatalyst on oxygen at 900 mV vs hydrogen. The value for our electrocatalyst is 44 mA per milligram of platinum and is projected to reach mA per milligram of platinum with improved electrode structures. Since the electrocatalyst surface area has not been optimized and the electrode structure has not been optimized, there is considerable room for performance enhancement beyond these values, especially at higher temperatures. There are now significant economic possibilities to either operate fuel cells at higher current densities or for halving the noble metal loading at fuel cell cathodes.

33441 **(DOE/NASA/12726—13) Preparation and characterization of electrodes for the NASA Redox storage system.** Reid, M.A.; Gahn, R.F.; Ling, J.S.; Charleston, J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1980. Contract AI04-80AL12726. 18p. (NASA-TM—82702; CONF-8009171—1). NTIS, PC A02/MF A01. Order Number DE81029959.

From Electrochemical Society meeting; Hollywood, FL, USA (5 Sep 1980).

The current status of electrodes for the NASA Redox energy storage system based on iron and chromium chloride reactants is discussed. Difficulties in making well-behaved electrodes for the chromium side of the flow cell have been largely overcome. The physical properties of several lots of felt were determined. Refined procedures were developed for evaluating electrode performance in lab-scale cells. Experimental procedures for evaluating electrodes by cyclic voltammetry are described which minimize the IR losses due to the high internal resistance in the felt (distributed resistance). Improved methods for preparing electrodes were discovered which reduced the coevolution of hydrogen at the chromium electrode and eliminated the drop in voltage on discharge occasionally seen with previous electrodes. Single cells of 0.33 $ft^2$ area with improved membranes and electrodes are operating at over 80 percent voltage efficiency and coulombic efficiencies of over 98 percent at current densities of 16 to 20 amp/$ft^2$.

33442 **(SERI/TR—332-416-Vol.2) Review of thermally regenerative electrochemical systems.** Chum, H.L.; Osteryoung, R.A. (Solar Energy Research Inst., Golden, CO (USA); State Univ. of New York, Buffalo (USA)). Apr 1981. Contract AC02-77CH00178. 223p. NTIS, PC A10/MF A01. Order Number DE81029624.

Thermally regenerative electrochemical systems (TRES) are closed systems that convert heat into electricity in an electrochemical heat engine that is Carnot cycle limited in efficiency. In this report, past and present work on TRES is reviewed and classified. Two broad classes of TRES can be identified according to the type of energy input required to regenerate the electrochemical cell reactants: thermal input alone or the coupling of thermal and electrolytic energy inputs. To facilitate the discussion, these two broad categories are further divided into seven types of TRES (Types 1 to 3 for thermal regeneration; Types 4 to 7 for coupled thermal and electrolytic regeneration). The subdivision was made according to significant differences in either the electrochemical cells or in the regenerators.

33443 **Application of molten carbonate fuel cells to OTEC-generated fuels.** O'Sullivan, J.B.; Camara, E.H. Chicago, IL; Institute of Gas Technology (1981). 7p. (CONF-810622—8).

From 8. ocean energy conference; Washington, DC, USA (7 Jun 1981).

Ocean thermal energy conversion is recognized as a valuable source of supplementary, renewable energy. This energy can be transported as electricity or as chemical energy (methanol, ammonia), depending on the distance between the OTEC plant and shore. Molten carbonate fuel cells (MCFC) can efficiently reconvert OTEC generated fuels to electric power that is available with no generation efficiency penalty. The status of MCFC technology is reviewed, and its potential application to generation of onshore power from OTEC-generated fuels is discussed. Also, MCFC power generation in cogeneration modes is discussed.

# 32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

**33444 (CONF-7803136—) Information for decision-makers. Energy conservation in industry and Department of Energy facilities.** (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). 15 Mar 1978. Contract AC03-77CS21693. 219p. NTIS, PC A10/MF A01. Order Number DE81025868.

From Energy conservation in industry and department of energy facilities conference; Alexandria, VA, USA (15 Mar 1978).

Proceedings of a meeting are presented dealing with measures the private sector and the government are taking or have taken to reduce energy consumption. Twelve papers are presented. Planning and managing energy conservation programs at Westinghouse; the energy program, how it works, and what results have been achieved at the Bell System in Virginia; and the 3M energy program are discussed in three papers. The technical and economic uncertainties in determining payback periods for energy conservation investments are discussed. Problems associated with the various energy sources are described, and strengthening the conservation priority in the Department of Energy facility energy consumption are discussed. Papers on innovative approaches to energy conservation at Standard Oil of Indiana, and programs to measure and evaluate energy conservation at Ohio State University are included. DOE energy conservation targets in the near-term and midterm are discussed as well as the DOE budget in-house conservation programs. Programs on the life-cycle costing methodology used by DOE to prioritize and rank its research projects; the incremental value of thermal insulation; and Argonne National laboratory's experience with HVAC modifications conclude the program. (MCW)

## 3201 Buildings

*REFER ALSO TO CITATION(S) 33104, 33162, 33175, 33191, 33396, 33397, 33465*

**33445 (BNL—29763) Assessment methodology for the air quality impact of residential wood burning.** Lipfert, F.W. (Brookhaven National Lab., Upton, NY (USA). National Center for Analysis of Energy Systems). 1981. Contract AC02-76CH00016. 20p. (CONF-810674—4). NTIS, PC A02/MF A01. Order Number DE81029373.

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Data from surveys of 1977-1979 indicate that firewood usage tends to vary inversely with population density, resulting in an implied limit to the density of usage. Tests of wood stoves indicate that emissions of particulates vary inversely with heat demand, such that nighttime emissions at low combustion rates may be worse than those during maximum heat demand conditions. Finally, atmospheric dispersion rates are coupled to the driving forces of space heating so that nighttime emissions tend to have a disproportionately large impact on ambient air quality. All of these factors must be considered jointly in order to perform a meaningful assessment of the air quality impacts of increased residential wood fuel use; the results indicate that in flat terrain primary ambient standards are not threatened by residential wood combustion.

**33446 (BNL—51321) Flame-retention head burner efficiency test results and analysis. Space-heating-equipment test program.** McDonald, R.J.; Krajewski, R.F. (Brookhaven National Lab., Upton, NY (USA)). Nov 1980. Contract AC02-76CH00016. 26p. NTIS, PC A03/MF A01. Order Number DE81030219.

Fuel oil savings resulting from the use of flame-retention head burners in residential oil-fired hydronic heating units are summarized. Results of laboratory and field tests are compared. The fuel savings varied between 5.1% and 22.0% for various systems.

**33447 (DOE/CS/20205—T17) Potential environmental issues related to building energy performance standards.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Sep 1978. Contract AC03-77CS20205. 17p. NTIS, PC A02/MF A01. Order Number DE81021861.

The report identifies and briefly discusses the potential direct and indirect environmental and socioeconomic impacts related to the promulgation of new energy conservation standards. The discussion on physical environmental concerns considers related health, safety, and resource issues, in addition to suggesting areas of further research for an Environmental Impact Statement. The analysis first discusses the general area of primary environmental impact related to new energy standards and then considers several potential impacts brought on by increased use or introduction of materials and products having recognized energy-saving features. Significant socioeconomic impacts such as the effects of energy standards on the labor market; worker/occupant performance; home costs; and loan acquisitions are discussed. The magnitude of the impacts are variable, dependent on geographic factors. Areas where related research could be conducted are noted. (MCW)

**33448 (DOE/CS/35224—T1) Variable capacity compressor controller.** Davis, A.; Keegan, P.J.; Peltzman, E. (Rho Sigma, Inc., North Hollywood, CA (USA)). 1979. Contract AC03-78CS35224. 90p. NTIS, PC A05/MF A01. Order Number DE81028998.

An examination was made of one method of improving the operational efficiency of a heat pump. The method involved changing the compression motor speed to vary the capacity of the heat pump to match the load. The first phase developed the variable capacity heat pump design requirements, selected a motor speed control technique, and generated a variable speed controller design. The design requirements were derived by analyzing the effects of varying the compressor speed on each of the major components of the heat pump. Various motor speed control techniques were analyzed, and a method was chosen which could theoretically provide the most efficient operation. This phase was concluded by designing a controller which would vary the compressor motor speed and adjust the elements of the heat pump based upon the structure's heat load requirements. The second phase was the development of the hardware to implement the variable capacity heat pump, using a two-speed heat pump which is a commercially feasible approach to the variable capacity heat pump problem. The controller was implemented using Rockwell 6502 microcomputer, the AIM 65. Results of a heat pump used to air condition a test facility in North Hollywood, California during the month of August, 1979, are discussed. Results on the dual capacity heat pump and controller indicate a 5 to 20% efficiency improvement over a constant capacity heat pump. (MCW)

**33449 (DOE/EIA—0272) National Interim Energy-Consumption Survey: exploring the variability in energy consumption.** (Department of Energy, Washington, DC (USA). Energy Information Administration). Jul 1981. 70p. NTIS, PC A04/MF A01. Order Number DE81029910.

Efforts to model the variation in total energy consumption and consumption by end-use reported in the National Interim Energy Consumption Survey are described. The report concentrates on regression models for describing the variability in natural gas and electricity consumption for households living in single-family detached houses. Section 1 provides a description of the NIECS sample data and the subsets of it that were used in the analyses. Several appendixes supplement this discussion. Section 2 presents a theoretical model for describing a household's energy consumption. Section 3 presents some graphical summaries of the data which serve to explain the specific models that were fit to the data and leads to some speculation about what contributes to their lack of fit. Section 4 describes the empirical models fit to the data, and the method of fitting, and relates them to the discussion in Section 2. Section 5 summarizes the results of the preceding sections and contains some speculation on interpretation of the model coefficients obtained in Section 4 and some potential uses of the model.

**33450 (LBL—11985) Energy efficiency buildings program, FY 1980.** (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 76p. NTIS, PC A05/MF A01. Order Number DE81028050.

A separate abstract was prepared on research progress in each group at LBL in the energy efficient buildings program. Two separate abstracts were prepared for the Windows and Lighting Program. Abstracts prepared on other programs are: Energy Per-

formance of Buildings; Building Ventilation and Indoor Air Quality Program; DOE-21 Building Energy Analysis; and Building Energy Data Compilation, Analysis, and Demonstration. (MCW)

**33451** (LBL—11985, pp 4.2-4.6) **Energy performance of buildings.** Grimsrud, D.; Blomsterber, A.; Carroll, W. May 1981. NTIS, PC A05/MF A01. Order Number DE81028050.

In Energy efficiency buildings program, FY 1980.

The objective of the Energy Performance of Buildings Group is to provide fundamental information on the energy performance of buildings as a basis for the eventual establishment of energy-conserving guidelines and standards governing the design and construction of new buildings as well as retrofit strategies for existing buildings. Progress is reported on research areas of air infiltration and wall thermal performance in the field, in the laboratory, and on computer models. Development of an instrumented residential energy audit, to be field-validated in FY 1981 is described. (MCW)

**33452** (LBL—11985, pp 4.7-4.30) **Building ventilation and indoor air quality.** May 1981. NTIS, PC A05/MF A01. Order Number DE81028050.

In Energy efficiency buildings program, FY 1980.

Research progress in the Building Ventilation and Indoor Air Quality Program is reported in five separate papers. Continuation tasks reported on are: laboratory studies of indoor combustion emissions, organic contaminants, and radon; field monitoring of indoor air quality in buildings; indoor air quality health-risk assessment studies; demonstration and assessment of residential mechanical ventilation systems incorporating air-to-air heat exchangers; and completion and implementation of a ventilation/indoor air quality data base. Completion of sub-contract activities on the assessment of ventilation requirements for odor control in buildings; assessment of hospital ventilation standards; and a study of automatic variable ventilation control systems based on air quality detection in institutional and commercial buildings are reported. Projected work for FY 1981 is described. (MCW)

**33453** (LBL—11985, pp 4.31-4.40) **Energy-efficient windows program.** Selkowitz, S.; Berman, S.; Johnson, R.; Klems, J.; Lampert, C.; Rubin, M.; Verderber, R. May 1981. NTIS, PC A05/MF A01. Order Number DE81028050.

In Energy efficiency buildings program, FY 1980.

Research progress is reported in four major areas: window performance (analytical modeling, performance testing); fenestration systems (transparent heat mirrors, high-performance sun-control systems, optical shutter materials, movable insulation systems, selective-reflectance coatings, air-flow window systems); daylighting; and program planning and support. Planned activities for FY 1981 are noted. (MCW)

**33454** (LBL—11985, pp 4.40-4.45) **Energy-efficient lighting program.** Berman, S.; Clear, R.; Klems, J.; Rubinstein, F.; Selkowitz, S.; Verderber, R. May 1981. NTIS, PC A05/MF A01. Order Number DE81028050.

In Energy efficiency buildings program, FY 1980.

The energy-efficient lighting program focuses on two major tasks. The first is the development, testing, and demonstration of energy-efficient light sources and equipment including (1) solid-state fluorescent ballasts; (2) switching and lighting controls; and (3) energy-efficient light bulbs. The second area concerns the science of illumination and illuminating systems, including (1) the physics of light sources and equipment; (2) visibility, illumination, and performance; and (3) health and environmental effects of illumination. Each of the projects, with accomplishments realized in 1980 and the activities planned for 1981, is described.

**33455** (LBL—11985, pp 4.45-4.49) **DOE-2.1 building energy analysis group.** Curtis, R.; Buhl, F.; Gates, S.; Hirsch, J.; Lokmankekim, M.; Olson, K.; Rosenfeld, A.; Rudy, J.; Winkelmann, F. May 1981. NTIS, PC A05/MF A01. Order Number DE81028050.

In Energy efficiency buildings program, FY 1980.

The purpose of this project has been to create, test, document, and maintain a user-oriented, public domain, computer program (DOE-2.1) that will enable architects and engineers to perform design studies of whole-building energy use under actual weather conditions. The completion of this program, which in its successive public generations has been known as Cal-ERDA, DOE-1.4, DOE-2.0A, and finally, DOE-2.1, is discussed. Among the additions and improvements that distinguish DOE-2.1 from its predecessor (DOE-2.OA) are its ability to create and to store custom weighting factors, its restructured simulation of the HVAC systems, and its integration of the active solar simulator; CBS, Component Based Systems. The improvements are discussed. (MCW)

**33456** (LBL—11985, pp 4.50-4.61) **Building energy data compilation, analysis, and demonstration.** Rosenfeld, A.; Arin, H.; Cleary, P. May 1981. NTIS, PC A05/MF A01. Order Number DE81028050.

In Energy efficiency buildings program, FY 1980.

Progress is reported on developing and refining a technology data base on the cost and performance of conservation measures in new and retrofitted houses and residential appliances. A program to compile data on commercial buildings and equipment was initiated. Using these data, along with the results of DOE-2 runs and other analyses made in support of the Buildings Energy Performance Standards, a major study of technical and economic potentials for conservation and solar use in California residences was completed. A similar study of conservation and solar potentials in all US buildings (residential and commercial) between now and the year 2000 were reviewed. A project was initiated to demonstrate audit/retrofit techniques, train an initial core group of utility and private industry personnel to demonstrate the techniques, and to measure resultant energy savings and cost-effectiveness in a sample of 26 northern California homes. Results to date from each of these projects are summarized. (MCW)

**33457** **(LBL—12259) Mobile infiltration test unit: its design and capabilities - preliminary experimental results.** Blomsterberg, A.K.; Modera, M.P.; Grimsrud, D.T. (Lawrence Berkeley Lab., CA (USA)). Jan 1981. Contract W-7405-ENG-48. 21p. NTIS, PC A02/MF A01. Order Number DE81031927.

The Mobile Infiltration Test Unit (MITU) is portable test structure designed and instrumented at Lawrence Berkeley Laboratory. It is a 12 $m^2$ (128 $ft^2$) construction-site office trailer modified to provide long-term field data for our air infiltration studies. This report describes the trailer and its instrumentation, including some preliminary tests of the individual measurement systems. MITU has a completely automated data-acquisition system that records air infiltration rates, surfaces pressures, and weather as half-hour averages. The shell of the trailer is well sealed, and the quantity, type, and distribution of leakage area are controlled using removable leakage panels in 16 window openings. Using the trailer's fan pressurization system, the background leakage area of the shell was measured to be 12 $cm^2$ (1.9 $in^2$), while the two types of leakage panels have leakage areas of 13 $cm^2$ (2.0 $in^2$) and 17 $cm^2$ (2.6 $in^2$). The infiltration measurement system was tested by inducing a known flow rate with the fan pressurization system, and predicted the flow rates to within 10% in all cases.

**33458** **(LBL—12777) Midway house-tightening project: a study of indoor air quality.** Offermann, F.J.; Girman, J.R.; Hollowell, C.D. (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 30p. NTIS, PC A03/MF A01. Order Number DE81030886.

To meet the increasing demand for energy, some utility companies are realizing that sponsoring residential conservation programs is an attractive economic alternative to building new power plants. Concern has arisen, however, that some conservation measures reduce the natural ventilation of the house and thus can degrade indoor air quality. To address this concern, the Bonneville Power Administration (BPA) and the Lawrence Berkeley Laboratory (LBL) conducted a cost-shared joint study of indoor air quality in twelve retrofitted houses of the BPA Midway Substation Residential Community (MSRC). Measurements of effective leakage areas and average concentrations of nitrogen dioxide, formaldehyde, and radon, were made before and after special house-tightening retrofits by LBL and BPA house doctors. The average reduction in leakage area resulting from these retrofits was 32%. None of

the pollutants measured before or after the retrofits, reached levels exceeding existing guidelines. The moderate increases in radon and formaldehyde concentrations observed are consistent with what would be expected from the estimated average decrease in air-exchange rates. Because the pre- and post-retrofit measurements involved only single, relatively short-term samples taken two months apart, uncertainties associated with the variability of source strength and occupant activities affecting ventilation remain and preclude any definitive conclusions that the increases observed are purely the result of the retrofits. A more conclusive study would require measurements of a larger sample of homes for a longer period of time, including simultaneous monitoring of control (unretrofitted) houses.

33459 **(ORNL/CON—59) Data collection and processing for the ACES.** Bledsoe, J.L.; Miller, D.R. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 167p. NTIS, PC A08/MF A01. Order Number DE81030630.

The Annual Cycle Energy System demonstration house furnishes information that is collected, processed, and analyzed on a weekly schedule. The computer codes used for processing and analyses were designed to display collected data; to summarize the performance (mechanical) of the house for each week; to give representation of external influences such as temperature, humidity ratio, and wind speed; and to aid in the dissemination of data to other users. Revisions and adjustments have been made to the codes to accommodate improvements made at the demonstration facility. The codes are written in either FORTRAN IV or Pl/I programming languages. All programs in the system run on the IBM 360 systems.

33460 **(PNL-SA—9049) Technology change and energy consumption: a comparison of residential subdivisions.** Nieves, L.A.; Nieves, A.L. (Pacific Northwest Lab., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 38p. (CONF-810757—2). NTIS, PC A03/MF A01. Order Number DE81030075.

From 56. annual conference of the western economic association; San Francisco, CA, USA (3 Jul 1981).

A study undertaken to assess the energy savings in residential buildings likely to result from implementation of the Building Energy Performance Standards (BEPS), is presented. The goals of the study were to: compare energy use in new homes designed to meet or exceed BEPS levels of energy efficiency with that in similar but older homes designed to meet conventional building codes, and to survey the home owners regarding their energy conservation attitudes and behaviors and to ascertain the degree to which conservation attitudes and behaviors are related to residential energy use. This paper first presents the consumer demand theory which provides the framework for the empirical analysis. Following the theory section, the sample residences are described and the data collection methods discussed. The definition and measurement of major variables are also presented. The third major section covers the empirical analysis, starting with a description and comparison of the old and new subdivisions on key variables, continuing with examination of relationships between key variables, and ending with an exploratory regression analysis. The paper concludes with an analysis of implications and suggestions for further research.

33461 **Thermal-energy-storage devices.** Blevins, R.P. Washington, DC; American Public Power Association (1980). 7p. (CONF-8009170—3).

From American Public Power Association energy management and communications workshop; Myrtle Beach, SC, USA (30 Sep 1980).

More than 60% of the energy consumed bythe residential sector provides comfort heating and cooling. Essentially, all residential cooling is accomplished with electrical devices and the percentage of homes electrically heated is increasing. Since space conditioning demands usually coincide with system peak loads, the load management potential of space conditioning is significant. Thermal energy storage (TES) is one means of capitalizing on this load management potential. A 1979 load management survey identified a total of 81 TES projects sponsored by 56 electric utilities. The TES systems can be classified as heat storage, cool storage, or hybrid heat-and-cool storage systems. The design, operation, and performance characteristics of each were studied, and payback figures were derived for each system under two basic rate structures. The basic conclusions reached in this study are that heat storage systems are commercially available and cost effective given even a modest off-peak rate differential. On the other hand, cool storage systems, except in a few small geographic areas, do not appear to be economically feasible for residential applications. (LCL)

## 3202 Transportation

*REFER ALSO TO CITATION(S) 33395, 33395, 33484, 33485*

33462 **(DOE/CS/51175—T18) Evaluation of the alternatives for contingency fuels in the commercial marine-transportation industry.** (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA). Transportation Consulting Div.). Jan 1979. Contract AC03-76CS51175. 95p. NTIS, PC A05/MF A01. Order Number DE81029835.

Results of a study to identify and evaluate alternate fuels and their applicability as contingency fuels for marine propulsion systems are presented. The approach to the study and the evaluation methodology are described. Ten alternate fuels were identified as having potential as contingency fuels and each is analyzed. Seven fuels were identified as having limited application as fuels for existing propulsion systems. These are discussed in Appendix B. Six alternate fuels were identified as having no applicability to existing marine propulsion systems and these are discussed in Appendix C. (MCW)

33463 **Options for fueling America's transportation.** Alm, A.L. Queenstown, MD; Aspen Institute for Humanistic Studies (1980). 55p. (NP—1903618).

The nature of the problems in fueling America's transportation system, the goal at which it should aim, and specific options open are discussed at the workshop. Chapter II assesses where the US stands on future supply and demand forecasts and on current private and public efforts to reduce energy dependence and vulnerability. The final chapter sets forth a series of specific recommendations for action. (MCW)

## 3203 Industry And Agriculture

*REFER ALSO TO CITATION(S) 32970, 33253, 33393*

33464 **(BNL—29880) Process models for industry.** Pierce, B.; Hill, D.; Howe, S.O. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 6p. (CONF-811030—1). NTIS, PC A02/MF A01. Order Number DE81029494.

From 4. world engineering congress; Atlanta, GA, USA (12 Oct 1981).

The purpose of this paper is to describe and illustrate how process models developed at BNL are used to analyze industrial energy use. A model of the US pulp and paper industry is described and discussed as a specific application of process modeling methodology. Case study results from the pulp and paper model illustrate how process models can be used to analyze a variety of issues. Applications discussed include projections of energy demand, conservation technology assessment, energy-related tax policies, and sensitivity analysis. A subsequent discussion of these results supports the conclusion that industry process models are versatile and powerful tools for energy end-use modeling and conservation analysis.

33465 **(DOE/CS/40087—T1) Handbook for energy conservation in food canning plants.** Rao, M.A.; Downing, D.L. (Cornell Univ., Geneva, NY (USA). Inst. of Food Science). Oct 1979. Contract AS01-78CS40087. 189p. NTIS, PC A09/MF A01. Order Number DE81028819.

Guidelines are presented so that personnel in food canneries can conserve energy. Information dealing with conservation applicable to food canneries is brought together in this handbook. Energy consumed in the production, harvesting, and the processing

of foods are discussed in Sections I and II. The main components of an energy conservation program are discussed in Section IV. A list of energy conservation opportunities suitable for food canneries is given in Section V. Good housekeeping practices in the areas of lighting, heating, water and electricity use, steam use, boiler and power plant operations, and by preventing leaks from steam lines, steam traps, combustible gas and compressed air lines are discussed in Section VI. Section VII deals with the definition of boiler efficiency, sources of energy losses in boilers, minimum instrumentation requirements of a boiler, boiler combustion control systems, and good boiler maintenance practices. It also contains discussion on improving boiler efficiency by modification of boiler operating practices and the use of auxiliary equipment. Substantial energy savings that can be achieved by insulation and heat recovery are discussed in Section VIII. The potential for the use of heat pumps to recover heat is also covered. Section IX describes recent developments in improving the efficiency of blanchers and sterilizers. The use of solar energy, indirect energy sources, and financial evaluation procedures of investments are also discussed. (MCW)

33466 **(DOE/ET/10415—T4) Development of potential uses for the residue from fluidized-bed-combustion processes. Quarterly technical progress report, March-May 1981.** Minnick, L.J. (Minnick (L. John), Plymouth Meeting, PA (USA)). 1981. Contract AC21-77ET10415. 30p. NTIS, PC A03/MF A01. Order Number DE81030157.

Progress on an extensive research program to evaluate the solid wastes from fluidized bed combustion for potential commercial uses is described. In addition, the investigation will explore methods by which the material can be safely disposed of should commercial applications be slow in developing, or not of sufficient magnitude to account for utilization of all of the waste materials. Previous research under this contract has clearly shown that spent bed materials from atmospheric fluidized bed (AFB) boilers are potentially useful in a number of commercial applications. Extensive laboratory studies to date have confirmed the fact that AFB residue materials from different sources do contain a substantial component of reactive lime which can, after proper processing, be concentrated and effectively separated from the residue. Furthermore, these spent bed materials also exhibit unusual cementitious properties when used as received or after processing in certain construction-related compositions. Major emphasis in this study has been directed towad evaluation of a number of different sources of AFB residue in the following areas of research: (1) characterization of AFB by-product materials; (2) determination of the most effective means of beneficiation or separation of these materials; (3) laboratory evaluation of the feasibility for use of AFB residue in such applications as a lime substitute, neutralization of acidic trade wastes, flue gas desulfurization, and the stabilization of highly plastic soils; and (4) performance testing of commercial applications involving some cementitious activity, such as in road base compositions, the production of structural materials, placement of structural fill material, and the dewatering and stabilization of sludges and slurries. (WHK)

33467 **(DOE/ET/11343—T2) Fluid-bed heat-exchanger optimization and bed materials selection. Final report.** (Aerojet Energy Conversion Co., Sacramento, CA (USA)). Feb 1981. Contract AC22-78ET11343. 127p. NTIS, PC A07/MF A01.

A study was undertaken to evaluate the effect of material properties on heat exchanger costs for waste gas streams from 500 to 3000°F. 400, 800, 1200, and 1600°F bed temperatures were used. The cost of the major heat exchanger components was identified and related directly to bed material properties. The overall heat exchanger costs were determined and used in a comparative analysis to assess the merit of each material. Two hundred materials were reviewed: metals, alloys, oxides, minerals, carbides, borides, intermetallics, and cermets. Compared to the lowest cost heat exchanger based on the best bed material, at 400°F, the cost of the heat exchanger for sand is 14% higher; at 800°F, 29% higher; at 1200°F, 23% higher, and at 1600°F, 25% higher. In comparing the heat transfer performance at 400°F, the sand bed had a 50% lower heat transfer coefficient compared to the top performer, resulting in 62% more heat transfer surface area. The general trend showed that the oxides and minerals were the most cost effective at the lower bed temperatures and the metallic bed materials at the higher bed temperature.

33468 **(DOE/ET/15426—T7) Program Plan: research and development for improved efficiency, small steam turbine project No. 1380, Phase II.** (Northern Research and Engineering Corp., Woburn, MA (USA)). 1981. Contract AC02-79ET15426. 42p. NTIS, PC A03/MF A01. Order Number DE81022152.

The approach that will be taken to execute and manage a program to provide a catalyst for the introduction of higher efficiency steam engines in the 500 to 5,000 hp range is described. Task breakdown and details are given in Section I. Section II presents plan cost, manpower plan, and includes reporting forms. (MCW)

33469 **(EPRI-CS—1992(Vol.1)) Evaluation of potential processes for recovery of metals from coal ash. Final report.** Canon, R.M.; Gilliam, T.M.; Watson, J.S. (Oak Ridge National Lab., TN (USA)). Aug 1981. 49p. NTIS, PC A03/MF A01. Order Number DE81904258.

This summary report describes the methods and results and conclusions of a two-year study that evaluated several processes for the removal of aluminum and trace metals from coal fly ash. Descriptions of the two most promising processes, direct hydrochloric acid leaching and pressure digestion acid leaching, are presented, in addition to a summary of trace-metal behavior and a discussion of the data required for further process improvement.

33470 **(EPRI-EA—1956(Vol.1)) Models for forecasting energy use in the US farm sector. Final report.** Christensen, L.R. (Data Resources, Inc., Lexington, MA (USA)). Jul 1981. 200p. NTIS, PC A09/MF A01. Order Number DE81904220.

In this study econometric models are developed and estimated for the purpose of forecasting electricity and petroleum demand in US agriculture. A structural approach is pursued which takes account of the fact that the quantity demanded of any one input is a decision made in conjunction with other input decisions. Three different functional forms of varying degrees of complexity are specified for the structural cost function, which describes the cost of production as a function of the level of output and factor prices. Demand for materials (all purchased inputs) is derived from these models. A separate model which breaks this demand up into demand for the four components of materials is used to produce forecasts of electricity and petroleum is a stepwise manner. A great deal of attention is focused on precise measurement of the inputs and their prices since good data are critical for reliable results. Making use of recent advances in economic theory and in the measurement of economic data, sound measures of two classes of labor, capital, land, materials, and energy inputs (petroleum and electricity) are constructed. These data are used to estimate the parameters of the structural models, employing state of the art econometric techniques. The three models are compared on the basis of their ability to predict electricity and petroleum in both short run and long run ex ante forecasting experiments. The results indicate that the most complex model performs better for short run forecasts, but the simpler models may provide more accurate forecasts for longer time horizons.

33471 **(ORNL/TM—7852) Cycle and performance analysis of absorption heat pumps for waste heat utilization.** Perez-Blanco, H.; Grossman, G. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 56p. NTIS, PC A04/MF A01. Order Number DE81030705.

This report describes a theoretical analysis of a double-stage absorption heat pump cycle, performed as the first step toward the construction of a laboratory working system. The heat pump designed to upgrade low-temperature waste heat by boosting its temperature typically from 60°C (140°F) to 120°C (250°F). The heat, whih may be available from a variety of sources, is thereby made useful for industrial and other applications. The system uses part of the low-temperature heat as its energy source and does not need outside power, except for running small auxiliary equipment. The heat pump employs an desorber/evaporator combination in which some hot water from the heat source is evaporated and the vapor is absorbed in a concentrated absorbent solution. The heat of absorption serves to raise the temperature of the rest of the hot water stream. Two stages of the above system are used in series to provide the desired temperature boost. Both are served by one de-

sorber which uses part of the waste heat to concentrate the solution. The study considers both open- and closed-cycle regeneration of the solution. The report describes the operation of the system and defines its performance criteria. Results of a computer study show the variation in performance with different design variables. Two working materials, LiBr-water and LiCl-water, are considered. The effect of different operating conditions is evaluated.

33472 **Determination of specific consumption of raw materials and energy in the chemical industry.** Madron, F.; Vanecek, V. *Chemicky Prumysl ;* **31**: No. 4, 214-217(1981). (In Russian).

Problems associated with the determination of the specific consumption of raw materials and energy in the chemical industry on the basis of plant measurements have been studied. Particular attention has been devoted to those problems that are specific for chemical production and which stem mainly from the complexity of chemical technological systems and associated chemical and energetical interconversions as well as from the plant measurements themselves. A method for determining the specific consumption is described that consists of a system analysis of the problem, plant measurements and data evaluation.

## 3206 Municipalities And Community Systems

*REFER ALSO TO CITATION(S) 33079*

33473 **(DOE/CS/20074—1) Moorhead district heating. Phase II. Final report.** Sundberg, R.E. (Minnesota Energy Agency, St. Paul (USA)). Jan 1981. Contract AC02-78CS20074. 429p. NTIS, PC A19/MF A01. Order Number DE81029689.

The objective of the Moorhead district heating project is to develop a demonstration cogeneration hot water district heating system that would be owned and operated by the City of Moorhead. The district heating system planned for Moorhead would use coal and cogenerated heat from the Moorhead power plant to heat the water that would be distributed through underground pipes to customers for their space and domestic water heating needs, serving a substantial portion of the commercial and institutional loads as well as single and multiple family residences near the distribution lines. Phase II provides the information required for the City of Moorhead to make the decision to obtain financial commitment and build the district heating system. The technical feasibility effort considered the distribution network, retrofit of the power plant, and conversion of heating systems in customers' buildings to use hot water from the district heating system. The system would be developed over six years. The economic analysis consisted of a market assessment, development of business plans for construction and operation of the system assumption and rationale documented, and an analysis of the financial impact of alternative economic assumptions. Rate design methodology, institutional issues, development risk, and the proposal for implementation are discussed. Appendices present information on building conversions (Moorhead State University and Concordia College); heating alternatives for Moorhead State University; an environmental assessment; some district heating communications; and a comparison of alternative technologies to district heating in Moorhead. (MCW)

33474 **(DOE/CS/20167—6) Review of the literature on the use of trommels in waste processing and resource recovery.** Williams, E. (National Center for Resource Recovery, Inc., Washington, DC (USA)). Jul 1981. Contract AC01-76CS20167. 60p. NTIS, PC A05/MF A01. Order Number DE81029908.

A review of the published literature on the design and operation of trommels used in municipal waste processing, processing and resource recovery is presented. A summary of the pertinent information which was found is presented. An appendix contains design and operating data on 13 trommels in the US. (MCW)

33475 **(DOE/CS/20243—1) Opelika resource recovery project: report on the technological and economic evaluation.** (Alabama Energy Management Board, Montgomery (USA); Auburn Univ., AL (USA). Dept. of Chemical Engineering). Jul 1981. Contract FG01-79CS20243. 127p. NTIS, PC A07/MF A01. Order Number DE81030098.

A technical and economic evaluation of a resource recovery facility was performed for the city of Opelika, Alabama. The city and surrounding areas were examined for waste stream characteristics and this data summarized and discussed. Markets for both energy and materials were identified, the potential and willingness to enter into long-term contracts were determined. Steps taken to secure participation in the purchase of recovered products were identified. Technological options for waste disposal were examined first on a general basis and as they specifically apply to the city. The technological options were ranked according to specific criteria of market characteristics, compatibility, and commercial viability. A particular resource recovery system applicable to Opelika was identified and an economic analysis performed to compare its relative costs to that of landfilling. Conclusions were drawn and basic recommendations made for the disposal of waste in the future.

33476 **(DOE/CS/20321—1) Demonstration of waste-sludge incinerator fuel reduction: pilot project report.** Verdouw, A.J.; Waltz, E.W. (Indianapolis Center for Advanced Research, IN (USA)). Jan 1980. Contract AS02-79CS20321. 149p. NTIS, PC A07/MF A01. Order Number DE81030163.

This report describes the results of a successful field research and demonstration project to reduce fuel consumption in existing multiple-hearth sewage sludge incinerators. The project was conducted on-site at the City of Indianapolis sewage sludge incineration facilities to (1) develop a more fuel efficient operating mode through combustion engineering analyses, and (2) conduct a hands-on operational demonstration of reduced fuel consumption.

33477 **(EPRI-EM—1968(Vol.1)) Utilization of waste heat from major transformer substations. Volume 1. Generic study. Final report.** Christensen, N.T. (Seattle City Light, WA (USA); Rocket Research Co., Redmond, WA (USA)). Aug 1981. 190p. NTIS, PC A09/MF A01. Order Number DE81904212.

Large substation transformers reject substantial thermal energy. Since these units are usually close-coupled to facilities requiring low-temperature thermal energy for space conditioning, the ability to recover and efficiently utilize this energy is of significant interest. The intent of this project was to analytically evaluate the technical and economic potential of transformer waste heat recovery and utilization and verify the analysis with subscale testing. A general system was designed and optimized for the recovery of transformer waste heat. Simplified analytical techniques were developed to assist utilities in both preliminary analysis and detail design analysis of specific systems, including system economics. Critical component performance parameters were identified for the preparation of detailed specifications. Criteria was established for the specific application of such systems through system economics. A national mail survey was conducted to determine the quantity and usability of transformer waste heat in the United States. A generic study and design and economics criteria, required to assess the viability of a specific system as well as complete the detail design, are presented.

33478 **(EPRI-EM—1968(Vol.2)) Utilization of waste heat from major transformer substations. Volume 2. Site-specific study. Final report.** Christensen, N.T. (Seattle City Light, WA (USA); Rocket Research Co., Redmond, WA (USA)). Aug 1981. 93p. NTIS, PC A05/MF A01. Order Number DE81904236.

The applicability of transformer waste heat utilization was examined by analyzing a site-specific application. The site is located in Seattle, Washington; the energy source is the Broad Street Substation and the energy user is the Pacific Science Center. A description of the system is presented in Section I. A preliminary heat source/heat service analysis is given in Section II. Transformer waste heat availability and system heat demand, the thermal performance and hydraulic analysis, overall system efficiency, oper-

ation flexibility, major component selection, and the thermal storage system are discussed. The substation site, the transmission system, and the retrofit of the Pacific Science Center are described. System cost details and a cash flow projection are given. (MCW)

**33479 (ORNL/TM—7757) Potential opportunities for revitalization of the Rochester, New York steam district heating system.** Gant, R.E.; Karnitz, M.A.; Easton, C.W.; Thiele, C.H. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 173p. NTIS, PC A08/MF A01. Order Number DE81030373.

The district heating system of Rochester, New York was founded in 1889 and prospered for the first seventy years. The steam system grew in conjunction with the electrical service and became accepted as the preferred service for new buildings in downtown Rochester. In 1963, the system was the fourth largest in the US and had a peak hourly sendout of 390 MW(t). The system served 621 customers and was growing steadily. Since 1963 there has been a loss of about 320 customers and the system's peak sendout has been reduced to 275 MW(t) in 1979. The loss of customers appears to be a combined result of a massive urban renewal program and the high price of steam. The urban renewal program removed many of former steam customers which have not been replaced. The increased cost of steam can be attributed to the increased cost of oil, the system's prime fuel. The system was originally designed, constructed, and operated on coal until the early 1970's. With federal legislation on emission and air quality regulations, Rochester Gas and Electric (RG and E) converted the pulverized coal-fired boilers to oil and natural gas. The system is presently earning a very low rate of return and there is the possibility of abandonment of the business. Three options were proposed to assist in making the system viable in order to serve the city and also to make it an attractive business venture. Two options represent potential short-term solutions: (1) conversion of a coal-fired unit to cogeneration and (2) building a municipal incinerator operated on refuse derived fuel. Both options would lessen the district heating system's dependence upon oil and scarce fuels. The third option is along range strategy to develop hot water heat islands adjacent to the downtown system. The successful development of heat islands would represent the first growth nodes for a major new district heating system in Rochester.

**33480 (TVA/OP/EDT—81/39) Potential for resource recovery from municipal solid waste in Warren County, Tennessee.** (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Demonstrations and Technology). Jun 1981. 85p. NTIS, PC A05/MF A01. Order Number DE81903570.

The purposes of this report are to describe a solid waste disposal concept that would be technically and economically feasible and to provide the framework for developing a solid waste energy recovery project for Warren County. This report describes a preliminary plan by which waste generated in the region can be processed into a marketable energy product while simultaneously providing a more acceptable method for solid waste disposal. The resource recovery option outlined expands the use of the steam manufactured from Waren County's municipal solid waste into 3 categories: industrial process steam, steam for district heating and cooling, and electrical generation.

**33481 Anti-pollution solid waste burning incinerator.** Lang, J.M. (to Care, Inc.). US Patent 3,707,128. 26 Dec 1972. vp.

This patent relates to incinerators capable of burning waste material. More particularly, this invention involves an antipollution incinerator which is effective in controlling the amount of byproducts of combustion introduced into the atmosphere. The incinerator includes a pressurized flame means directed across a flue entrance opening whereby the pressurized flame produced a restrictive air block of the flue opening thereby increasing pressure within the combustion chamber.

**33482 Pollution control for a multi-fuel burning facility.** Bell, D.E. Lexington, KY; University of Kentucky (1981). 10p. (CONF-8104107—5).

From 12. annual Kentucky industrial coal conference; Lexington, KY, USA (29 Apr 1981).

Pollution control problems associated with co-firing or alternating firing municipal solid wastes with coal at resource recovery facilities are discussed. A brief review of resource recovery technology is presented. Calorific values of the fuels (coal, RDF, municipal solid wastes) are compared. Air pollution and control measures for particulates, sulfur dioxide, chlorides, and dioxins are discussed briefly. (MCW)

### 3209 Education And Public Relations

**33483 (BNL—51381) Energy future: a primer for secondary school teachers.** Metz, D.J. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 16p. NTIS, PC A02/MF A01. Order Number DE81030829.

Brookhaven Lecture Series Number 169, November 14, 1979.

BNL's educational involvement with the local secondary school teaching community is described. The origin of the venture, funding information, and eligibility to participate in the Energy Institute are reviewed. The format is described and involves three segments. Segment I involves basic sciences which provide background information and knowledge needed for succeeding Segments. Segment II concerns individual energy technologies detailing particular aspects of coal and synthetic fuels; oil and gas; nuclear (fission and fusion); solar; and conservation. Segment III covers broad energy problems, generally cutting across most technologies. Activities in the workshops are described. Some indication of the impact of the efforts on the teachers and ultimately on their students and their communities is attempted. (MCW)

## 33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

### 3301 Internal Combustion Engines

**33484 (DOE/CS/54224—T1-Vol.1) Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 1. Executive summary.** (General Electric Co., Cincinnati, OH (USA). Advanced Energy Programs Dept.). 31 Jul 1980. Contract AC01-78CS54224. 51p. (AED-EO—17-Vol.1). NTIS, PC A04/MF A01. Order Number DE81025739.

The application of Rankine Bottoming Cycle (RBC) technology to marine diesel engines in the US commercial maritime industry was evaluated on technical, environmental, and economic bases with emphasis on the energy conservation potential of near-term commercialization of RBC systems. In this volume, the study results are presented followed by a brief summary of the major task results. Among the results and conclusions are the following: the RBC economics are most favorable and indicate a discount rate of return on investment of about 25%; no environmental nor institutional barriers were identified; fuel savings of 50 million barrels by the year 2000 are forecast from implementation of RBC systems in the marine push-tow industry alone; RBC can be retrofitted on existing vessels or installed in new vessels with few technical obstacles; the market potential exists; and the successful completion of a one-year demonstration of the RBC installed in a push-tow boat engaged in normal revenue generating operations is the single most important requirement for RBC commercialization in the marine and other industries. (LCL)

**33485 (DOE/CS/54224—T1-Vol.2) Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 2. Final technical report.** (General Electric Co., Cincinnati, OH (USA). Advanced Energy Programs Dept.). 31 Jul 1980. Contract AC01-78CS54224. 356p. (AED-EO—17-Vol.2). NTIS, PC A16/MF A01. Order Number DE81025939.

This volume presents a discussion of the various tasks of this study, the results of which were summarized in Volume 1. An evaluation of Rankine Bottoming Cycle (RBC) systems and inland waterways push-tow boats led to the selection of a RBC system and a vessel size which were used for the preliminary design and subsequent evaluations. The preliminary design considered various ways

to transmit the RBC power to the vessel propulsion system and several ways to cool the RBC condenser. RBC system component designs, control system design, installation analyses and system performance analyses over several duty cycles were carried out. System assessments were performed in three areas: (1) economics; (2) environmental, safety and institutional impact; and (3) operational reliability and maintenance. The market potential for the marine RBC was evaluated, including market definition, potential market penetration, and potential fuel savings for three market penetration scenarios. A program plan was prepared for the Rankine Bottoming Cycle Marine Demonstration Program.

33486 **(DOE/NASA/1011—34) Cold-air performance of compressor-drive turbine of Department of Energy upgraded automobile gas turbine engine. I. Volute-manifold and stator performance.** Roelke, R.J.; Haas, J.E. (National Aeronautics and Space Administration, Cocoa Beach, FL (USA). John F. Kennedy Space Center; AVRADCOM Research and Technology Labs., Cleveland, OH (USA)). May 1981. 16p. (NASA-TM—82682). NTIS, PC A02/MF A01. Order Number DE81028520.

The aerodynamic performance of the inlet manifold and stator assembly of the compressor-drive turbine of the Upgraded Gas-Turbine Engine was experimentally determined with cold air. The investigation was made to determine: the losses within the manifold; the flow conditions entering and leaving the stator; and the stator blading performance. The aerodynamic evaluation of the manifold and stator will subsequently be-used for evaluating the turbine rotor performance from overall stage data. The experimental conditions and measuring methods are described. The loss in total pressure in the inlet manifold ranged from 0.4 to 0.5%; however, the design swirl was not achieved near the endwalls. The underturning of the flow near the endwalls resulted in positive stator incidence as high as 19° at one circumferential position. Measurements also indicated a thick hub boundary layer at the stator inlet. The aftermixed stator efficiency between 20 and 90% span was generally equal to the design value of 0.965 but fell off appreciably at the endwalls. The overall aftermixed efficiency calculated for that part of the span surveyed (7 to 95%) was 0.959. An extrapolation of the survey measurements to the endwalls was made in an attempt to include the endwall losses. The overall aftermixed efficiency calculated from the extrapolated data was 0.936. An analysis of the factors contributing to the overall loss in kinetic energy (1-efficiency) showed the following elements: profile, trailing-edge drag, and mixing, 0.035; incidence, 0.006; endwall boundary layer, 0.010; and secondary flow, 0.014. Comparison of the subject stator showed that the small stators had comparable kinetic energy losses which were 50 to 100% more than the larger stators.

33487 **(DOE/NASA/51040—22) Test results of the Chrysler upgraded automotive gas-turbine engine: initial design.** Horvath, D.; Ribble, G.H. Jr.; Warren, E.L.; Wood, J.C. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jul 1981. Contract AI01-77CS51040. 64p. (NASA-TM—81660). NTIS, PC A04/MF A01. Order Number DE81030418.

The Chrysler upgraded automotive gas turbine engine as built to the original design was deficient in power and had excessive specific fuel consumption. As part of a corrective action program under the Department of Energy Heat Engine project, NASA tested a highly instrumented version of the engine at the Lewis Research Center to identify the sources of the engine problems. Analysis of the data shows the major problems to be low compressor and power turbine efficiency and excessive interstage duct losses. In addition, high HC and CO emissions were measured at idle, and high NO/sub x/ emissions at high engine speeds.

33488 **Stroboscopic laser shadowgraph study of the effect of swirl on homogeneous combustion in a spark-ignition engine.** Witze, P.O.; Vilchis, F.R. (Sandia Lab, USA). *SAE (Society of Automotive Engineers) Preprint ;* No. 810226, vp(Feb 1981).

A photographic study is presented illustrating the influence of mixture motion on flame propagation in an internal combustion engine. Variation in swirl and turbulence levels was achieved by rotating the orientation of a shroud on the intake valve. Laser Doppler velocimetry was used to characterize the precombustion fluid motion. A flexible shadowgraph system was developed for visualizing in-cylinder events.

33489 **Maximizing efficiency of fuel production and utilization.** Koehler, D.E.; Marshall, W.F. (US DOE, Bartlesville, Okla). *SAE (Society of Automotive Engineers) Preprint ;* No. 810062, vp(1981).

An experimental study was undertaken to determine the influence of fuel octane quality, engine compression ratio, and ignition timing adjustment on fuel utilization efficiency. This information, combined with data on refinery energy consumption for producing fuel of various octane qualities, can be used to estimate the potential for improvement in miles traveled per barrel of crude oil consumed. The vehicle selected for this investigation incorporated a closed-loop, air/fuel ratio control system using an oxygen sensor and a three-way catalyst. Ignition timing was adjusted for minimum fuel consumption at each of three compression ratios with the engine operating on fuels of various octane quality. An ignition timing retard system was used for those combinations of compression ratio and fuel quality which precluded use of best ignition timing. 4 refs.

## 3302 External Combustion Engines

33490 **(DOE/NASA/51040—31) High-power baseline and motoring test results for the GPU-3 Stirling engine.** Thieme, L.G. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jun 1981. Contract AI01-77CS51040. 43p. (NASA-TM—82646). NTIS, PC A03/MF A01. Order Number DE81030834.

In support of the Department of Energy's Stirling Engine Highway Vehicle Systems program, the NASA Lewis Research Center has installed a 7.5-kilowatt (10-hp) GPU-3 Stirling engine with a motoring dynamometer to continue to obtain data for validating Stirling-cycle computer simulations and to prepare for future component testing. The engine was originally built by General Motors Research Laboratories for the US Army in 1965 as part of a 3-kilowatt engine-generator set. Baseline tests were run to map the engine over a range of mean compression-space pressures of 2.8 to 6.9 megapascals (400 to 1000 psi) and engine speeds of 1500 to 3500 rpm with both helium and hydrogen as the working fluid. All tests were run at a heater-tube gas temperature of 677°C (1250°F). Maximum power obtained with hydrogen was 6.82 kilowatts (9.14 hp) at 6.9 megapascals (1000 psi) and 3500 rpm. The maximum power with helium was 4.26 kilowatts (5.71 hp) at 6.9 megapascals (1000 psi) and 2500 rpm. The highest brake thermal efficiencies obtained were 26.4 percent for hydrogen and 21.3 percent for helium. These both occurred at 6.9-megapascal (1000-psi) mean compression-space pressure and 1500-rpm engine speed. The engine output was low at high speeds as compared with that for the previously reported low-power baseline tests that used the alternator and resistance load bank instead of the dynamometer. It is felt that this reduced power was caused by degradation of heat exchanger effectiveness as a result of contamination by rust and oil. However, efficiency was higher than in the previous tests because of the installation of a noncontaminated preheater that reduced combustion system losses.

## 3303 Electric-powered Systems

*REFER ALSO TO CITATION(S) 33380*

33491 **(SAND—81-1814C) Evaluation of the SCR controller noise problem.** Bassett, R.B.; Barnaby, B.E. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 8p. (CONF-811010—2). NTIS, PC A02/MF A01. Order Number DE81026462.

From 6. electric vehicle council symposium; Baltimore, MD, USA (21 Oct 1981).

Several types of solid state controllers are available for application to electric vehicles. The silicon controlled rectifier (SCR) type provides a current waveform of fixed pulse height and variable ratio on to off time. The controller provides step-free operation through a four-speed manual transmission. However, because

the current is chopped, the circuits produce loun hums of varying frequency, which in some mounting situations may be amplified. This noise disappoints those who expect an electric vehicle to boast relatively silent operation. To evaluate the problem, components of a test bed, consisting of a battery bank, dc motor, SCR controller, charger, and appropriate cabling, were fitted with accelerometers, and the noises were evaluated for amplitude and spectral characteristics. Transient currents and voltages were also measured and analyzed to identify the source of the noise and the frequencies involved.

**33492 (UCRL—86560) Development of the aluminum-air battery for electric vehicle applications.** Cooper, J.F.; Homsy, R.V. (Lawrence Livermore National Lab., CA (USA)). 12 Aug 1981. Contract W-7405-ENG-48. 11p. (CONF-810938—1). NTIS, PC A02/MF A01. Order Number DE81028446.

From 4. international EVDG conference and demonstration; London, UK (15 Sep 1981).

Current progress is reported concerning the development of hardware for the aluminum-air electric vehicle battery. The polarization curves of large-scale aluminum-air cells (0.1-$m^2$ anodes) have been replicated in rapidly-refuelable cells of subscale size (167-$cm^2$) which were constructed for stacking into multicell modules. Solution-side current collection by a structure which makes point- or line contacts at the aluminum/electrolyte interface is described. The technique allows rapid anode addition, minimizes anode fabrication costs, and simplifies cell design. The possible application of solution-side current collection to wedge-shaped cells allowing continuous anode feed and full utilization is discussed. Life-cycle testing of air electrodes in candidate battery electrolytes is reported. Temperature and aluminate concentration transients are modeled using experimental rate data. Program structure, technical strategy, goals, and economic analysis are briefly discussed.

**33493 Feasibility of electric vehicles in New Zealand.** Noble, J.P.; West, J.; Randle, J.B.; Ritchie, P.D.; Owen, J. Aukland, New Zealand; New Zealand Energy Research and Development Committee (1981). 45p. (NZERDC—61;LF—2009).

The objectives of this study were to: (1) provide a state of the art review of current electric vehicle technology both in New Zealand and overseas; (2) determine the role of electric vehicles in New Zealand having regard to local vehicle use patterns and the availability of alternative transport fuels; (3) prepare an economic assessment of electric vehicle applications in comparison to other vehicles; (4) assess national benefit of electric vehicle utilization; and (5) identify further research, development and demonstration requirements to define the potential of, and implementation strategies for, electric vehicle use in New Zealand. Results are presented and discussed. (WHK)

### 3307 Emission Control

*REFER ALSO TO CITATION(S) 33487*

### 3308 Alternative Fuels

**33494 Alternative liquid fuels.** Canberra, Australia; Australian Government Publishing Service (1980). 116p. (NEAC—12).

This report reviews the status of the various technologies to produce substitutes for liquid fuels for transport and mobile machinery. Prospects for Australia are considered in detail, and conclusions and recommendations are presented in relation to both the general issues and to specific substitutes. Important objectives in the report have been to summarize the status of current technology and to provide a broad basis for comparing costs. Costs are expressed in 1980 Australian dollars. The first chapter of the report deals with general issues and is followed by a chapter on recent international developments. Separate chapters deal with LPG, methanol, ethanol, shale oil, oil from coal, CNG and substitute diesel fuels, and a following chapter provides a comparative assessment of the various competing technologies. The concluding deals with the likely future impact of alternative liquid fuel developments on the labour market, the capital market, the environment and the refining industry. The scope of this report does not extend to indirect methods of substitution such as electric cars, electrification of railways or to the replacement of oil by gas or coal in nontransport applications, or to those alternative liquid fuel prospects which are in a very early stage of technological development (e.g. hydrogen). This report complements the Committee's Report No. 9: Liquid Fuels: Longer Term Needs, Prospects, and Issues. That report drew attention to the increasing gap between the demand for liquid fuels in Australia and the indigenous production from existing oil fields. The present report examines the possibility of closing the gap by producing substitute fuels. This step will prove to be necessary as the future import supply situation grows more fragile and if major new discoveries continue to elude us.

## 36 MATERIALS

**33495 (CONF-800804—43) Role of engineering judgement and the computer in the management of material property data.** Booker, M.K. (Oak Ridge National Lab., TN (USA)). 1980. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE81028630.

From ASME century 2 emerging technology conference; San Francisco, CA, USA (10 Aug 1980).

The considerations involved in development of a successful computer based data system include the following: several specialized systems are preferred to a single all-encompassing system; the system should be directed by materials experts, but should utilize computer experts; all aspects of the system should emphasize flexibility; an on-line master file should be maintained with off-line backup files; characterization of data should take precedence over volume of data; accuracy of input data should take precedence even over characterization; an interactive, on-line, textural-numerical search and retrieval program is needed; and the system should be a dynamic data management tool, not a passive repository for data-flexible capabilities for analysis and display of data are essential.

**33496 (LBL—12000) Materials and Molecular Research Division annual report 1980.** (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 562p. NTIS, PC A24/MF A01. Order Number DE81027828.

Progress made in the following research areas is reported: materials sciences (metallurgy and ceramics, solid state physics, materials chemistry); chemical sciences (fundamental interactions, processes and techniques); nuclear sciences; fossil energy; advanced isotope separation technology; energy storage; magnetic fusion energy; and nuclear waste management.

**33497 Research in materials. Annual report.** Cambridge, MA; Massachusetts Institute of Technology (1981). 470p. (NP—1904042).

This is the twentieth in the series of Annual Reports on Research in Materials at the Massachusetts Institute of Technology, issued on behalf of the Institute by the Center for Materials Science and Engineering. A listing of the current Central Facilities follows: insulating and optical crystal growth; crystal preparation; microelectronics and ion implantation; analytical facility; x-ray diffraction; surface analytical facility; scanning electron microscopy; scanning transmission electron microscopy and transmission electron microscopy; Fourier transform infrared spectroscopy and optical spectroscopy; and ceramics materials processing.

### 3601 Metals And Alloys

*REFER ALSO TO CITATION(S) 32803, 32835, 32835, 32949, 33041, 33088, 33289, 33289, 33289, 33329, 33340, 33548, 33573, 33592, 33622, 33640, 33660, 33661, 33662, 33699, 33706, 33953, 33957, 34043, 34048, 34126, 34127, 34128, 34131*

**33498 (BNL—29779) Thermal conductivity measurements of insulators for fusion blankets.** Horn, F.L.; Fillo, J.A.; Powell, J.R. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 5p. (CONF-810831—50). NTIS, PC A02/MF A01. Order Number DE81030028.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Alumina-silica mat (8 lb/ft$^3$) varied in thermal conductivity in air and Ar from 0.06 W/m- K at 300°C to 0.22 W/m- K at 1000°C, but in He it increased to 0.24 W/m- K at 300°C and 0.54 W/m- K at 1000°C, while in steam it was about midway between these values. The carbon and graphite felts behaved similarly, but the rigid and denser (24 lb/ft$^3$) zirconia fiberboard exhibited superior insulating properties: 0.07 W/m- K at 300°C and 0.14 W/m- K at 1000°C in air and Ar, and 0.13 W/m- K at 300°C and 0.17 W/m- K at 1000°C in steam, but rising to 0.15 W/m- K at 300°C and 0.49 W/m- K at 1000°C in He. The lighter zirconia felt (14 lb/ft$^3$) in steam at 1000°C was thought to be best at 0.23 W/m- K and only 0.40 W/m- K in He at 1000°C.

33499 **(BNL—29941) Comparison of hydrostatic extrusion versus wire drawing as a method of producing $Nb_3Sn$ superconducting wire.** Thadani, V.; Avitzur, B.; Chou, Y.T.; Luhman, T.S. (Brookhaven National Lab., Upton, NY (USA); Lehigh Univ., Bethlehem, PA (USA). Dept. of Metallurgy and Materials Engineering). 1981. Contract AC02-76CH00016. 5p. (CONF-8105111—1). NTIS, PC A02/MF A01. Order Number DE81030275.

From 9. north american manufacturing research conference; University Park, PA, USA (19 May 1981).

The conventional manufacturing process for $Nb_3Sn$ multifilamentary superconducting wire is a combination of hot extrusion and wire drawing. An alternative process, cold hydrostatic extrusion, was developed. All experimental data pertaining to the hydrostatic extrusion process are presented, and a comparison is made between the two manufacturing methods. The results show that monofilamentary $Nb_3Sn$ wire produced by hydrostatic extrusion not only has good superconducting properties, but also that larger reductions are achieved per pass, and fewer and shorter intermediate anneals are required in its manufacture.

33500 **(BNL—30016) Interaction of stress with the martensitic phase transition in A15 compounds.** Welch, D.O. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 10p. (CONF-810835—26). NTIS, PC A02/MF A01. Order Number DE81030527.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

Recently there has been a resurgence of interest in the effect of the martensitic phase transition which occurs in many A15 compounds on superconductivity and on elastic and anelastic behavior. Since in many practical applications, A15 compounds are subject to considerable stress and strain, it is of interest to examine the interaction of stress with the martensitic transition; this paper is an examination of the effects of stress predicted by a simple Landau model which successfully describes many features of the transition and the related temperature dependence of the elastic modulus $(c_{11}-c_{12})/2$. The effect of stress on the temperature ranges of stability and metastability of various types of martensitic domain is discussed. The non-linearity of the stress-strain relation in a polycrystalline A15 is studied.

33501 **(BNL—30018) Superconducting current densities in bronze-processed $Nb_3Sn$ multifilamentary wires.** Okuda, S.; Suenaga, M.; Luhman, T.S. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 11p. (CONF-810835—28). NTIS, PC A02/MF A01. Order Number DE81030566.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

Five multifilamentary wires with diameters of 0.41 mm and different ratios of bronze to Nb (R = 2 to 3.7) were obtained from Airco. The superconducting critical currents were measured at 4.2°K in magnetic fields of 8 to 19 T. Effects of heat treatments were investigated. 4 figures. (DLC)

33502 **(BNL—30019) Superconducting properties of $(Nb,Ti)_3Sn$ wires fabricated by the bronze process.** Suenaga, M.; Okuda, S.; Sabatini, R.; Itoh, K.; Luhman, T.S. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 12p. (CONF-810835—27). NTIS, PC A02/MF A01. Order Number DE81030556.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

A study was made of the influence of the alloying addition of Ti in the Nb core on the superconducting critical properties since (1) Ti is less expensive than Nb or Ta, (2) Ti has a lower melting temperature than Ta and Nb, thus making the alloy fabrication easier, (3) Ti-Nb alloys are also known to be easily fabricated in composite wires with Cu, and finally (4) it appears that an increased normal-state resistivity rho/sub n/, and therefore the upper critical field H/sub c2/, will lead to enhanced J/sub c/ at high fields. It is expected that the addition of Ti will increase the rho/sub n/ of the $Nb_3Sn$. As shown in preliminary results, small additions of Ti to the Nb can significantly enhance critical-current densities of $Nb_3Sn$ at high magnetic fields (H > 12 T). A detailed account of this study is given.

33503 **(CONF-800280—) Proceedings of the interdisciplinary meeting on hydrogen in metals.** (Department of Atomic Energy, Bombay (India)). 1980. 325p. NTIS (US Sales Only), PC A14/MF A01. Order Number DE81904020.

From Interdisciplinary meeting on hydrogen in metals; Bombay, India (19 Feb 1980).

Out of the seventeen invited talks and twenty-two contributed papers which were included in the final program, ten invited papers and seventeen contributed papers are presented in the Proceedings, with part of the discussions which followed the presentations. All the discussions could not be recorded and to that extent the proceedings are incomplete.

33504 **(CONF-810391—1) Slip systems and solid solution softening/hardening in BCC metals.** Meshii, M. (Northwestern Univ., Evanston, IL (USA). Dept. of Materials Science and Engineering). 1981. Contract AS02-76ER01367. 9p. (COO—1367-121). NTIS, PC A02/MF A01. Order Number DE81028883.

From US National Science Foundation and Japan Society for the Promotion of Science seminar; Honolulu, HI, USA (Mar 1981).

Solid solution softening phenomenon is re-examined with special attention to intrinsic/extrinsic mechanism controversy. It appears that the existence of intrinsic solid solution softening is gaining support in many bcc metals. The existence, however, is still questioned in Nb and Ta. In this report the recent observations supporting the intrinsic mechanism in Nb are reviewed. Solid solution hardening is observed in cases where the solvent metal deforms extensively by the coplanar double slip mode and softening in those which deform primarily by the single slip mode. 3 figures.

33505 **(CONF-810831—11) Preirradiation microstructural development designed to minimize properties degradation during irradiation in austentic alloys.** Maziasz, P.J.; Roche, T.K. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE81028612.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The first-generation Prime Candidate Alloy (PCA) for the austenitic stainless steel class of alloys for application as a Magnet Fusion Energy (MFE) first-wall material is a 14 Cr-16 Ni-0.25 Ti modification of Type 316 stainless steel. A key parameter for material performance is wall lifetime. The ability of the material to resist swelling and resist embrittlement during irradiation is important to longer wall lifetimes. The microstructure that evolves during irradiation is primarily responsible for both the swelling and embrittlement responses, and helium plays a central role in this microstructural evolution. This paper indicated how preirradiation microstructures that employ control of MC precipitation and dislocation density are designed and produced for fusion application of PCA.

33506 **(CONF-810866—1(Draft)) Self-consistent approximation beyond the CPA: Part II.** Kaplan, T.; Gray, L.J. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 34p. NTIS, PC A03/MF A01. Order Number DE81029659.

From NATO advanced study institute on excitations in disordered systems; E Lansing, MI, USA (23 Aug 1981).

In Part I, Professor Leath has described the substantial efforts to generalize the CPA. In this second part, a particular self-consistent approximation for random alloys developed by Kaplan, Leath, Gray, and Diehl is described. This approximation is applicable to diagonal, off-diagonal and environmental disorder, includes cluster scattering, and yields a translationally invariant and analytic (Herglotz) average Green's function. Furthermore Gray and Kaplan have shown that an approximation for alloys with short-range order can be constructed from this theory.

33507 **(CONF-810943—2) Chemical thermodynamic analysis of the interaction of 304 SS with the gases and the $CaSO_4$ deposit in the fluidized-bed combustor.** Lindemer, T.B.; Pearson, R.L. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 40p. NTIS, PC A03/MF A01. Order Number DE81029675.

From Conference on chemistry of materials at high temperatures; Harwell, Oxfordshire, UK (7 Sep 1981).

This paper applies recently developed thermodynamic techniques to a theoretical analysis of the corrosion of heat-exchanger tubes in the fluidized-bed coal combustor. These techniques permit determination of the equilibrium phases at any location, or series of locations, in a reaction zone from two sets of data. One set is the aggregate elemental composition at any position in the interface, which can be experimental, such as from a microprobe analysis, or theoretical, such as from an assumed model of reaction zone compositions. The second set is the value of the Gibbs free energy of formation for each of the condensed and gaseous species that could conceiveably exist in the system. Analysis of the subject system at the Fe-Cr-Ni-Mn composition of type 304 stainless steel suggests that the presence of a $CaSO_4$ deposit on 304 SS is a sufficient condition for reactions that produce oxides and sulfides. Formation of $Ni_3S_2$ in the reaction zone is indicated, which infers the presence of the deleterious 910 K Ni-liquid-$Ni_3S_2$ eutectic, as has been suggested from experimental work. In addition, the presence of $CaFe_2O_4$ spinel, first considered here, appears to be necessary for the formation of sulfides of manganese and iron, which are observed experimentally. Other information includes identification of equilibria controlling sulfur and oxygen pressures within the reaction zone andvariation of the equilibrium phase concentrations across the interface, the latter information being a potentially useful guide to experimental identification of reaction product phases.

33508 **(DOE/ER/10814—1) Zero-flux planes and flux reversals in multicomponent diffusion. Progress report, January 1, 1981-August 31, 1981.** Dayananda, M.A. (Purdue Univ., Lafayette, IN (USA). School of Materials Engineering). Aug 1981. Contract AC02-81ER-10814. 38p. NTIS, PC A03/MF A01. Order Number DE81028526.

The principal area of research is to explore the development and role of the zero-flux planes (ZFP) and flux reversals in both single phase and multiphase diffusion couples in the Cu-Ni-Zn and Fe-Ni-Cr ternary systems. Both single phase and multiphase diffusion couples have been assembled with $\alpha$(fcc) and/or $\beta$(bcc) Cu-Ni-Zn alloys with similar thermodynamic activities of either Cu, Ni, or Zn and diffusion annealed at 775°C. ZFP's where the interdiffusion flux of one of the components goes to zero have been identified in several couples. The ZFP compositions are found to correspond to intersection points of diffusion paths and isoactivity lines drawn through the terminal alloys on an isotherm. In the second project, similar studies of interdiffusion are underway with $\gamma$(fcc) Fe-Ni-Cr alloys at 1100°C for the determination of interdiffusion coefficients and diffusional interactions. In the third project, preliminary sandwich couples where two ZFP's move towards each other are being set up with selected Cu-Ni-Zn alloys at 775°C for studies of possible ZFP interaction and regulation of interdiffusion fluxes.

33509 **(DOE/NASA/2593—22) Effects of trace impurities in coal-derived liquid fuels on deposition and accelerated high-temperature corrosion of cast superalloys.** Lowell, C.E.; Deadmore, D.J.; Santoro, G.J.; Kohl, F.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1981. Contract AI01-77ET10350. 17p. (NASA-TM—81678; CONF-810309—8). NTIS, PC A02/MF A01. Order Number DE81030378.

From ASME gas turbine conference; Houston, TX, USA (9 Mar 1981).

This is a review of work describing effects of trace metal impurities in coal-derived liquids on deposition, high temperature corrosion, and fouling. Alloys were burner rig tested from 800 to 1100°C, and corrosion was evaluated as a function of potential impurities. Actual and doped fuel tests were used to define an empirical life prediction equation. An evaluation of inhibitors to reduce or eliminate accelerated corrosion was made. Barium and strontium were found to limit attack. Intermittent application of the inhibitors or silicon additions were found to be effective techniques for controlling deposition without losing the inhibitor benefits. A computer program was used to predict the dew points and compositions of deposits. These predictions were confirmed in deposition tests. The potential for such deposits to plug cooling holes of turbine airfoils was evaluated. Tests indicated that, while a potential problem exists, it strongly depended on minor impurity variations.

33510 **(EPRI-NP—1931) Engineering approach for elastic-plastic fracture analysis.** Kumar, V.; German, M.D.; Shih, C.F. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Jul 1981. 226p. NTIS, PC A11/MF A01. Order Number DE81904218.

This report for RP1237-1 presents formulas, charts, and background material that allow calculation of safety margins in ductile structures containing flaws. It is intended as a reference book for engineers who are concerned with design and analysis of flawed structures. The work extends the analysis procedures already available for brittle elastic materials to the tough and ductile steels used in the construction of pressure-boundary components. These new elastic-plastic methods more accurately describe the behavior of ductile materials and show more tolerance to flaws than the elastic methods contained in the ASME Boiler and Pressure Vessel Code and the Code of Federal Regulations.

33511 **(HEDL-SA—2317) Notch tensile behavior of irradiated 20% cold-worked Type 316 stainless steel.** Huang, F.F.; Fish, R.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Dec 1980. Contract AC14-76FF02170. 22p. (CONF-810606—95). NTIS, PC A02/MF A01. Order Number DE81028170.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

Test results show that the notch sensitivity of 20% cold worked Type 316 stainless steel is dependent on irradiation temperature as well as test temperature. The temperature dependence becomes evident as the test temperature increases to 600°C. At 232°C, significant irradiation effects on the strength of 20% cold worked Type 316 stainless steel were observed. Irradiation hardening results from the introduction of various microstructural components which impede moving dislocations. For irradiation temperature $\leqq$ 500°C, the strength of irradiated 20% cold worked Type 316 stainless steel increases with increasing fluence up to a fluence of about 4 x 10 n/cm$^2$. Little additional hardening occurs beyond this fluence. The notch sensitivity changes from a notch strengthening at lower fluences to a notch weakening at a fluence of 7.8 x $10^{22}$ n/cm$^2$ because of the inability of the material to relieve stress concentrations around a notch.

33512 **(HEDL-SA—2338-FP) Microstructural examination of several commercial ferritic alloys irradiated to high fluence.** Gelles, D.S. (Hanford Engineering Development Lab., Richland, WA (USA)). 1981. Contract AC14-76FF02170. 6p. (CONF-810831—45). NTIS, PC A02/MF A01. Order Number DE81029800.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Microstructural observations are reported for a series of five commercial ferritic alloys, 2 1/4 Cr-1 Mo, H-11, EM-12, 416, and 430F, covering the composition range 2.25 to 17% chromium, following EBR-II irradiation over the temperature range 400 to 650°C and to a maximum fluence of 17.6 x $10^{22}$ n/cm$^2$ (E > 0.1 MeV). These materials were confirmed to be low void swelling with maximum swelling of 0.63% measured in EM-12 following irradiation at 400°C to 14.0 x $10^{22}$ n/cm$^2$. A wide range of precipitation response was found both as a function of alloy and irradiation temperature. Precipitates observed included $M_6C$, $Mo_2C$, Chi, Laves, $M_{23}C_6$, $\alpha'$ and a low temperature phase as yet unidentified. It is predicted,

based on these results, that the major impact of irradiation on the ferritic alloy class will be changes in postirradiation mechanical properties due to precipitation.

33513 **(HEDL-SA—2341) Swelling of several commercial alloys following high fluence neutron irradiation.** Powell, R.W.; Peterson, D.T.; Zimmerschied, M.K.; Bates, J.F. (Hanford Engineering Development Lab., Richland, WA (USA)). Jan 1981. Contract AC14-76FF02170. 6p. (CONF-810831—48). NTIS, PC A02/MF A01. Order Number DE81029804.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Swelling values have been determined for a set of commercial alloys irradiated to a peak fluence of 17.8 x $10^{22}$ n/cm$^2$ (E > 0.1 MeV) over the temperature range of 400 to 650°C. The alloys studied fall into three classes: the ferritic alloys AISI 430F, AISI 416, EM-12, H-11 and 2 1/4 Cr-1 Mo; the superalloys Inconel 718 and Inconel X-750; and the refractory alloys TZM and Nb-1 Zr. After irradiation to a peak fluence approaching goal exposures envisioned for advanced fusion reactor first walls, all of the alloys display swelling resistance far superior to cold worked AISI 316. Of the three alloy classes examined the swelling resistance of the ferritics is the least sensitive to composition.

33514 **(HEDL-SA—2342-FP) Effects of transmutation products on swelling in 316 stainless steel.** Bates, J.F.; Garner, F.A.; Mann, F.M. (Hanford Engineering Development Lab., Richland, WA (USA)). 1981. Contract AC14-76FF02170. 5p. (CONF-810831—47). NTIS, PC A02/MF A01. Order Number DE81029805.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Application of the extensive data base developed in fission reactors to the design of fusion reactors requires an understanding of the differences in the characteristics of the two neutron spectra. This paper presents the results of a study in which the isotopic evolution of AISI 316 was calculated for two breeder reactors, two fusion devices and the High Flux Isotope Reactor (HFIR). The largest changes in composition arise in HFIR, where the manganese is strongly depleted and substantial vanadium is generated. Both of these elements increase in fusion reactors but much more slowly. Data on the swellings of AISI 316 is presented to show that depletion of manganese in HFIR will lead to changes in the swelling behavior. Swelling behavior may be altered by vanadium in a manner typical of other strong MC-carbide forming elements such as titanium.

33515 **(HEDL-SA—2357) Damage development and hardening in 14 MeV neutron irradiation of copper alloys at 25°C.** Brager, H.R.; Garner, F.A.; Panayotou, N.F. (Hanford Engineering Development Lab., Richland, WA (USA)). Jul 1981. Contract AC14-76FF02170. 6p. (CONF-810831—44). NTIS, PC A02/MF A01. Order Number DE81029780.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Copper and copper alloyed with five atom percent of either aluminum, nickel or manganese were irradiated at 25° with 14 MeV neutrons to fluences up to 7.5 x $10^{17}$ n/cm$^2$ (0.003 dpa). The radiation-induced microstructure of these materials was characterized by the coupled use of electron microscopy and microhardness. The irradiation-induced microhardness changes were found to be independent of alloy identity and the magnitude of the solute-induced hardening. It appears that at least 70% of the defect clusters are smaller than resolvable by microscopy (~ 1 nm). The point defects at 25°C which survive recombination and aggregate in either visible or invisible clusters constitute at least 8% of those produced in the cascades.

33516 **(HEDL-SA—2359) Comparison of the swelling and the microstructural/microchemical evolution of AISI 316 irradiated in EBR-II and HFIR.** Brager, H.R.; Garner, F.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Jul 1981. Contract AC14-76FF02170. 6p. (CONF-810831—49). NTIS, PC A02/MF A01. Order Number DE81029754.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The microstructural and microchemical evolution has been compared for one heat of cold worked 316 stainless steel irradiated in both HFIR and EBR-II at 500 to 620°C. The dislocation and cavity densities and the swelling at high fluence are remarkably insensitive to the over two orders of magnitude difference in helium/dpa ratios. While the microchemical evolution is also largely unaffected, minor differences were observed possibly arising from solid transmutants that form only in HFIR. The reported absence of $\gamma'$ phase in specimens irradiated in HFIR at these temperatures reflects its sluggish formation in both reactors. The microchemical evolution is accompanied by the development of a swelling rate typical of steels irradiated in fast reactors. The magnitude of this swelling rate is corroborated by HFIR data on this same heat in the solution annealed condition.

33517 **(HEDL-SA—2475) Miniaturized fatigue crack growth specimen technology and results.** Puigh, R.J.; Bauer, R.E.; Ermi, A.M.; Chin, B.A. (Hanford Engineering Development Lab., Richland, WA (USA)). 11 Jun 1981. Contract AC14-76FF02170. 16p. NTIS, PC A02/MF A01. Order Number DE81029757.

The miniature fatigue crack propagation technology has been extended to in-cell fabrication of irradiated specimens. Baseline testing of selected titanium alloys has been performed at 25°C in air. At relatively small values for the stress intensity factor, $\Delta K$, the crack growth rates for all titanium alloys investigated are within a factor of three. The crack growth rates for these titanium alloys are a factor of three greater than the crack growth rates of either 316SS (20% CW) or HT-9. Each of the titanium alloys has observable crack propagation for stress intensity factors as small as 4.2 MPa$\sqrt{m}$.

33518 **(IS-M—338) Effect of applied stress on the transformation behavior of Ni-Ti.** Hsu, C.H.; Wechsler, M.S. (Ames Lab., IA (USA)). 1981. Contract W-7405-ENG-82. 5p. (CONF-810860—1). NTIS, PC A02/MF A01. Order Number DE81029838.

From ASM international conference on solid-solid phase transformations; Pittsburgh, PA, USA (10 Aug 1981).

Measurements of axial strain, circumferential strain, and electrical resistivity are made on Ni-Ti tubes of approximate composition 55 wt % nickel as a function of temperature cycling through the austenite-martensite transformation range. The tests are performed under various constant deadweight tensile loads. It is observed that the magnitudes of the transformation strain increase with increasing applied tensile stress. The results are interpreted in terms of the crystallographic multiplicity of the martensite plates and the alteration of the martensite plate substructure in response to the applied stress.

33519 **(IS-T—918) Mechanical properties and hydrogen embrittlement of scandium.** Zalesky, M.P. (Ames Lab., IA (USA)). Feb 1981. Contract W-7405-ENG-82. 95p. NTIS, PC A05/MF A01. Order Number DE81030745.

Thesis.

The strength and ductility of polycrystalline scandium have been studied as a function of hydrogen concentration and test temperature. The effects of hydrogen on the mechanical behavior of scandium are discussed in terms of current embrittlement concepts for hydride forming metals. Hydrogen concentrations ranging from 0.20 to 20.83 atomic percent and temperatures from 78 to 473K were employed in this investigation. SEM fractographs are shown to illustrate the modes of tensile failure.

33520 **(IS-T—926) Superconductivity in Th-Nb composites.** Goodrich, L.F. (Ames Lab., IA (USA)). 1980. Contract W-7405-ENG-82. 144p. NTIS, PC A07/MF A01. Order Number DE81030746.

Thesis.

Heat capacities, critical temperatures and critical currents have been measured for directionally solidified eutectic Th-Nb wires in order to determine whether superconductor-normal metal boundary is a strong pinning center for quantized vortices. The heat capacity data show that there is a large change in pair potential at the super-normal boundaries as predicted by de Gennes

boundary conditions. The T/sub c/ data were used to evaluate the extrapolation length b, and to show that Ginsburg-Landau predicts the changes in the superconductors rather well. Hence, the equilibrium thermodynamical properties are predicted from the filament size and spacing rather well.

33521 **(LA-UR—81-2426) Shock-compression measurements at pressures greater than 1 TPa.** Ragan, C.E. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-810827—10). NTIS, PC A02/MF A01. Order Number DE81030113.

From 8. AIRAPT conference and 19. EHPRG conference; Uppsala, Sweden (17 Aug 1981).

Precise Hugoniot data were obtained for samples of aluminum, quartz, iron, molybdenum, and low-density molybdenum ($rho_0$ = 8.29 g-cm$^{-3}$) using the impedance-matching technique. An underground nuclear explosion drove a nearly planar, 5-TPa shock into a molybdenum standard. Shock velocities were measured with 1.5% to 2.5% accuracies.

33522 **(LA-UR—81-2437) Effect of cyclic pulsed temperature on void growth in metals during irradiation.** Kmetyk, L.N.; Sommer, W.F.; Weertman, J. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 7p. (CONF-810831—55). NTIS, PC A02/MF A01. Order Number DE81030112.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The analysis of Brailsford and Bullough on radiation-produced point defect transport to lattice sinks and the analysis of Ghoniem and Kulcinski of pulsed radiation have been extended to include the effects of radiation-induced temperature oscillations. We have already shown in earlier papers that these temperature pulses enhance void growth if the ambient temperature is below the peak swelling temperature and, conversely, decrease void growth when the ambient temperature is above the peak swelling temperature. When the temperature pulses were suppressed, no difference was seen between void growth under steady and pulsed irradiation. In this paper, we show that the same effects on void growth can be obtained by superposing externally-produced temperature pulses on material under steady irradiation. Calculations have been done for aluminum and molybdenum for sinusoidal temperature pulses of many amplitudes and frequencies.

33523 **(LA-UR—81-2444) Structural relaxation rates in amorphous Metglas alloys $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_{80}B_{80}$.** Cost, J.R.; Stanley, J.T. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-810851—3). NTIS, PC A02/MF A01. Order Number DE81030111.

From 4. international conference on rapidly quenched metals; Sendai, Japan (24 Aug 1981).

Measurements made on the Metglas 2826 alloy at an anneal temperature of 250° are presented which again strongly indicate that the temperature-change induced reaction involves four simple first order processes. In addition, results of an unsuccessful attempt to find a similar effect in the binary metallic glass $Fe_{80}B_{20}$ are analyzed.

33524 **(LA-UR—81-2455) Temperature-induced transformation in a Pu-2at.% Al alloy.** Hecker, S.S.; Zukas, E.G.; Morgan, J.R.; Pereyra, R.A. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 10p. (CONF-810860—4). NTIS, PC A02/MF A01. Order Number DE81030109.

From ASM international conference on solid-solid phase transformations; Pittsburgh, PA, USA (10 Aug 1981).

The $\delta$ phase stabilized with 2 at.% aluminum transforms to a monoclinic $\alpha'$ phase at low temperatures by a thermally activated nucleation and displacive/diffusionless mechanism. The $\alpha'$ phase is an expanded monoclinic lattice suggesting a valence change in the $\alpha$-Pu atoms as a result of trapping smaller, trivalent aluminum atoms. The transformation sequence appears to be directly $\delta \rightarrow \alpha'$. The $\alpha'$ product is plate-like, resembling a lenticular martensite.

33525 **(LA-UR—81-2456) Pressure-induced transformation in a Pu-2at.% Al alloy.** Zukas, E.G.; Hecker, S.S.; Morgan, J.R.; Pereyra, R.A. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 11p. (CONF-810860—3). NTIS, PC A02/MF A01. Order Number DE81030108.

From ASM international conference on solid-solid phase transformations; Pittsburgh, PA, USA (10 Aug 1981).

Transformation of the face-centered cubic (fcc) $\delta$ phase of plutonium stabilized with 2 at.% aluminum was studied during hydrostatic compression using a Bridgman-type pressure dilatometer. The transformation is displacive/diffusionless and proceeds from $\delta \rightarrow \beta' \rightarrow \alpha'$ at room temperture. Both the $\beta'$ and $\alpha'$ phases contain aluminum solutes in supersaturated solution. In the $\beta'$ the aluminum solute causes no change in the lattice parameters, whereas in the $\alpha'$ it causes an expansion similar to that reported for temperature-induced transformation. Annealing experiments demonstrated that when the aluminum solute was permitted to diffuse out of the $\beta'$ lattice no change in lattice parameters occurred, but the phase was no longer stable at room temperature, indicating that it reverted to normal $\beta$. The morphology of the $\beta'$ formed by hydrostatic compression appears lath-like, resembling a strain-induced martensite.

33526 (LBL—12000, pp 497-500) **Magnetic fusion energy.** Morris, J.W. Jr. Jun 1981. NTIS, PC A24/MF A01. Order Number DE81027828.

In Materials and Molecular Research Division annual report 1980.

The project is intended to identify and develop improved materials for structural use in high field superconducting magnets. The principal focus of the research work has been on the continued development of ferritic structural steels which promise substantial advantages in mechanical properties and cost in structural applications at 4°K. Since magnet cases are field-welded structures, materials development requires the identification of appropriate welding methods, as well as the development of suitable heat treatment for the base plate.

33527 (LBL—12000, pp 513-514) **High strength austenitic alloys for generator retaining rings.** Morris, J.W. Jr. Jun 1981. NTIS, PC A24/MF A01. Order Number DE81027828.

In Materials and Molecular Research Division annual report 1980.

Ta-modified (5%) ultrahigh strength precipitation-hardened austenitic steels were developed for use as retaining rings in large electrical generators. Yield strengths after various heat treatments almost reached 200 ksi. (DLC)

33528 **Imaging of small distortions in A15 'lattice' by electron microscopy.** Pande, C.S. (Brookhaven National Lab., Upton, NY (USA)). *Solid State Communications ;* **37**: No. 9, 753-756(Mar 1981).

One effect of high energy nuclear radiation on A15 compounds has been postulated earlier to be a loss of translational symmetry of the lattice. Direct evidence of such distortions in $Nb_3Sn$ irradiated with high energy neutrons, using moire fringes is reported. The distortion is found to increase with increasing fluence, up to a fluence of 2 x 10$^{19}$ cm$^{-2}$.

33529 **(ORNL/TM—7970) Metals and Ceramics Division materials science program. Annual progress report for period ending June 30, 1981.** McHargue, C.J. (comp.). (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 273p. NTIS, PC A12/MF A01. Order Number DE81030697.

Information is presented concerning the theoretical studies of metals and alloys; x-ray diffraction research; structural ceramics; structure of coal; analytical and high-voltage electron microscopy; deformation and mechanical properties; mechanisms of surface and solid-state reactions; physical properties research; metastable materials; neutron radiation effects; charged particle radiation effects; theory and modeling of radiation effects; facility and advanced technique development; fundamentals of welding and joining; and studies in nondestructive evaluation.

33530 **(PNL-SA—9266) Pulsed-irradiation creep in nickel.** Simonen, E.P.; Henager, C.H. Jr. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1981. Contract AC06-76RL01830. 5p. (CONF-810831—53). NTIS, PC A02/MF A01. Order Number DE81030078.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Results from a series of pulsed irradiation creep tests have indicated a significant effect of beam heating on pulsed irradiation creep behavior. A pulsing effect due to intermittent atomic displacement damage was not observed. Sheet metal specimens were irradiated at 473 K using 15 MeV deuterons and a stress of 200 MPa. The pulse cycle consisted of 1000 seconds of irradiation followed by 100 seconds of annealing. Pulsed irradiation creep behavior was compared with steady irradiation creep behavior. The experimental results were interpretted using models of intermittent displacement damage and theories of temperature history effects.

33531 **(PNL-SA—9446) Relative effects of S, Sb and P on the intergranular fracture of iron and nickel tested at cathodic potentials.** Jones, R.H.; Bruemmer, S.M.; Thomas, M.T.; Baer, D.R. (Pacific Northwest Lab., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 5p. (CONF-810584—3). NTIS, PC A02/MF A01. Order Number DE81030076.

From NATO advanced study institute on atomistics of France; Corsica, France (22 May 1981).

Evidence that S, Sb and P participate in the embrittlement of iron and nickel tested at cathodic potentials by decreasing the critical intergranular fracture stress or by enhancing hydrogen permeation was examined and it was concluded that some elements may affect one or the other or possibly both processes.

33532 **(PNL-SA—9728) Stress dependence of creep in Ni bombarded with 17-MeV deuterons.** Henager, C.H. Jr.; Simonen, E.P.; Bradley, E.R.; Stang, R.G. (Pacific Northwest Lab., Richland, WA (USA); Washington Univ., Seattle (USA). Dept. of Mining and Metallurgical and Ceramic Engineering). Jul 1981. Contract AC06-76RL01830. 6p. (CONF-810831—54). NTIS, PC A02/MF A01. Order Number DE81030080.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

A linear stress dependence of irradiation creep was observed in pure, heavily cold-worked Ni and the creep behavior was modeled using a climb-glide creep mechanism. The Ni foils were bombarded with 17 MeV deuterons at 473 K with a damage rate of 6 x $10^{-7}$ dpa/s. The applied tensile stress ranged from 135 MPa to 250 MPa. Transmission electron microscopy revealed that up to 50% of the material had recrystallized during the pre-irradiation thermal creep test. A high number density of interstitial loops were observed throughout the material. Small voids were observed primarily in the recrystallized regions. The creep rate magnitude and stress dependence was rationalized using models of loop hardening of rate theory predictions of point defect annihilation at sinks.

33533 **(SAND—81-1358C) Time-resolved wave profile measurements in copper to Megabar pressures.** Chhabildas, L.C.; Asay, J.R. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 7p. (CONF-810827—5). NTIS, PC A02/MF A01. Order Number DE81026109.

From 8. AIRAPT conference and 19. EHPRG conference; Uppsala, Sweden (17 Aug 1981).

Many time-resolved techniques have been developed which have greatly aided in the understanding of dynamic material behavior such as the high pressure-dynamic strength of materials. In the paper, time-resolved measurements of copper (at shock-induced high pressures and temperatures) are used to illustrate the capability of using such techniques to investigate high pressure strength. Continuous shock loading and release wave profiles have been made in copper to 93 GPa using velocity interferometric techniques. Fine structure in the release wave profiles from the shocked state indicates an increase in shear strength of copper to 1.5 GPa at 93 GPa from its ambient value of 0.08 GPa.

33534 **(Y/DV—134) Effects of tensile deformation on the strain memory behavior of uranium-niobium α″ martensite.** Vandermeer, R.A.; Carpenter, D.A.; Northcutt, W.G. Jr.; Ogle, J.C. (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). Aug 1981. Contract W-7405-ENG-26. 9p. (CONF-810860—2). NTIS, PC A02/MF A01. Order Number DE81030285.

From ASM international conference on solid-solid phase transformations; Pittsburgh, PA, USA (10 Aug 1981).

Tensile testing, dilatometry and x-ray diffraction techniques were used to characterize the effects of deformation on the strain memory behavior of α″ martensite in a U+14.63 at% (6.25 wt %) Nb alloy. The reversible strain limit in tension was determined to be 7%. The reversible deformation was accompanied by a reorientation of martensite. Certain favored orientations increased in volume fraction at the expense of less favored ones, suggesting that deformation occurred by the movement of intervariant interfaces and/or twin boundaries. When plastic deformation prevailed, a reversal in the reorientation mechanism resulted and the ensuing strain recovery was diminished in extent. The heat-activated strain reversal attained a maximum value of 4.2% and was associated, as expected, with martensite reversion. Increasing amounts of deformation caused the strain recovery kinetics to be inhibited, resulting in a broader temperature range over which strain reversal was detected.

33535 **In-reactor creep rupture of 20% cold-worked AISI 316 stainless steel.** Lovell, A.J.; Chin, B.A.; Gilbert, E.R. (Hanford Engineering Development Lab., Richland, WA (USA)). *Journal of Materials Science ;* **16**: No. 4, 870-876(Apr 1981).

Results of an experiment designed to measure in-reactor stress-to-rupture properties of 20% cold-worked AISI 316 stainless steel are reported. The in-reactor rupture data are compared with postirradiation and unirradiated test results. In-reactor rupture lives were found to exceed rupture predictions of postirradiation tests. This longer in-reactor rupture life is attributed to dynamic point defect generation which is absent during postirradiation testing. The in-reactor stress-to-rupture properties are shown to be equal to or greater than the unirradiated material stress-to-rupture properties for times up to 7000 h.

33536 **Thorium doped iridium alloy for radioisotope heat sources.** Inouye, H.; Liu, C.; Schaffhauser, A.C.; White, C.L. (to to Department of Energy). US Patent 4,253,872. 3 Mar 1981. Filed date 16 Feb 1977. vp.

A novel iridium alloy containing 100-500 ppm thorium has enhanced impact properties over undoped iridium and over prior art iridium alloys.

33537 **Radiation effects in superconducting fusion-magnet materials.** Brown, B.S. (Argonne National Lab., IL (USA). Materials Science Div.). *Journal of Nuclear Materials ;* **97**: No. 1/2, 1-14(Mar 1981).

Economic considerations appear to dictate the use of superconducting magnets in magnetic fusion reactors. Since these magnets will experience high fluxes of energetic neutrons and secondary gammas, it is important to know the effects of this radiation on the operating characteristics of the magnets. Experimental data on radiation effects in the individual magnet components (superconductors, stabilizers, insulators, and structural materials) are reviewed here; cryogenic irradiations (approx. < 10 K) are emphasized, since these are required for design data. There is a dearth if information on the effects of low-temperature irradiation of insulators and an irradiation program is strongly recommended. The relative importance of property changes in the various components depends on the details of the individual magnet design and the importance of various factors (alternate materials, shielding thickness and penetrations, periodic anneals, etc.) can be analyzed only after the radiation-induced property changes of the components are incorporated into the specific design.

33538 **Microstructure and tensile properties of heavily irradiated 5052-0 aluminium alloy.** Farrell, K. (Oak Ridge National Lab., TN (USA)). *Journal of Nuclear Materials ;* **97**: No. 1/2, 33-43(Mar 1981).

During neutron irradiation of an Al-2.2% Mg solid solution alloy in the High Flux Isotope Reactor to fast and thermal fluences $> 10^{27}$ neutrons(n)/m$^2$ at 328 K (0.35 Tsub(m)) about seven percent insoluble, transmutant silicon was produced. Some of this silicon reacted with the dissolved magnesium to form a fine precipitate of $Mg_2Si$. A tight dislocation structure was also created. The alloy showed good resistance to cavity formation. These microstructural features are responsible for pronounced strengthening and an associated marked loss in ductility as revealed by tensile tests at 323, 373, and 423 K (0.35, 0.40 and 0.45 Tsub(m)). These changes were greater than in magnesium-free aluminium and in alloys containing preexisting, thermally-aged $Mg_2Si$ precipitate. Increasing the thermal-to-fast flux ratio from 1.7 to 2.1 caused further strengthening beyond that expected from a simple increase in silicon level.

33539 **Similar dependence on dilute O concentration of void formation in ion-irradiated Nb and some properties of unirradiated Nb.** Loomis, B.A.; Gerber, S.B. (Argonne National Lab., IL (USA). Materials Science Div.). *Journal of Nuclear Materials ;* **97**: No. 1/2, 113-125(Mar 1981).

The dependence on oxygen concentration of the void diameter, void number density, and void volume fraction in 3.0 MeV $^{58}Ni^+$ ion-irradiated Nb was determined at 1050, 1200, 1240 and 1270 K. Also, the dependence of the lattice parameter and the yield stress of unirradiated Nb on oxygen concentration was determined for 0.001 to 1.0 a/o oxygen. The void diameter and lattice parameter data are shown to have a similar dependence on oxygen concentration. Also the void number density and the yield stress of Nb are shown to have a similar dependence on O concentration. The interpretation of these results is based on the observation of microstructural features in irradiated and unirradiated Nb by transmission electron microscopy.

33540 **Phase relations in the thorium-cadmium system.** Bates, J.; Ader, M.; Meisenhelder, J.; Shinn, W.; Tani, B.S.; Krumpelt, M. (Argonne National Lab., IL (USA)). *Journal of the Less-Common Metals ;* **77**: No. 2, 205-213(Feb 1981).

A partial phase diagram for the Th-Cd system was established using chemical analysis, electron probe microanalysis (EPM), differential thermal analysis and X-ray diffraction (XRD) techniques. The solubility of thorium in cadmium can be represented by the equations log (wt.%Th) = $7.349\text{-}5458T^{-1}$ in the range 599-841 K and log (wt.%Th) = $7.705\text{-}10142T^{-1} + 3.688 \times 10^6T^{-2}$ in the range 841-1021 K. The most cadmium-rich phase, $ThCd_{11}$, decomposes peritectically at 568°C into $ThCd_5$ plus saturated liquid. Phases previously suggested to be $ThCd_{11}$, $ThCd_5$ and $ThCd_2$ were confirmed by EPM and a new phase, $ThCd_3$, was identified by EPM and XRD (hexagonal, a = 6.775 A and c = 4.928 A).

33541 **Oxygen potentials of plutonia and urania-plutonia solid solutions.** Woodley, R.E. (Westinghouse Hanford Co., Richland, WA (USA). Hanford Engineering Development Lab.). *Journal of Nuclear Materials ;* **96**: No. 1/2, 5-14(Jan 1981).

Oxygen potential-composition relations have been determined at temperatures from 1000 to 1200°C on mixed urania-plutonia fuels containing 10 and 40 mol% plutonia. Although it was found that the oxygen potential for these fuels as well as urania-25 mol% plutonia can be represented by a single equation of the form initially suggested by Schmitz, the proposal of Markin and McIver that the oxygen potential is a function only of the Pu valence was also substantiated. In addition, the oxygen potential of hypostoichiometric plutonia as a function of the oxygen-to-plutonium ratio has been measured and these data used to calculated activity coefficients for plutonia dissolved in urania and in thoria. The calculated activity coefficients indicate an increasingly positive deviation from ideality with decreasing Pu valence.

33542 **Solution of hydrogen in $TaV_2$.** Lynch, J.F. (Brookhaven National Lab., Upton, NY (USA)). *Journal of Physics and Chemistry of Solids ;* **42**: No. 5, 411-419(1981).

$TaV_2$ may be prepared as a random bcc alloy or as a (C-15) Laves phase. The behaviour of hydrogen dissolved in bcc $TaV_2$ is significantly different from that exhibited by hydrogen dissolved in (C-15) $TaV_2$. The bcc $TaV_2/H_2$ system is similar to pure vanadium/$H_2$; in the region of hydrogen solid solution, the electronic contribution to the thermodynamics of solution is negligible and the system exhibits apparent H-H attractive interactions. A non-stoichiometric fcc dihydride is formed at psub($H_2$) = 10 atm, T = 273 K. (C-15) $TaV_2$ does not form a hydride phase; hydrogen is continuously absorbed into solid solution to a maximum hydrogen content H/M approximately = 0.60. The solid solution of hydrogen in (C-15) $TaV_2$ exhibits trends which are typical of intermetallic/$H_2$ systems. The dilute hydrogen region is marked by a strong positive deviation from Sieverts' Law, and the relative partial molar enthalpy of solution becomes less exothermic as the hydrogen content is increased. $\Delta V$ vs H/M relationships and $\Delta S_{sub}(H)$ vs H/M relationships indicate that hydrogen segregation at the metal surface or at abnormally stable trapping sites does not contribute significantly to the thermodynamic behaviour exhibited by hydrogen in (C-15) $TaV_2$. Analysis of the excess free energy of hydrogen suggests that electronic effects may exert a significant influence on the behaviour of hydrogen in (C-15) $TaV_2$, even at dilute hydrogen contents. It is suggested that the random substitution of tantalum into the vanadium lattice exerts a significantly greater effect on the vibrational entropy of dissolved hydrogen than does the structural transformation bcc $TaV_2 \rightarrow$ (C-15) $TaV_2$.

33543 **Analysis of non-metals in metals.** Kraft, G. (ed.). Berlin, Germany; Walter de Gruyter and Co. (1981). 559p. (CONF-8006186—).

From International conference on analysis of non-metals in metals; Berlin, F.R. Germany (10 Jun 1980).

Non-metals in metals have the most varied effects on the properties of the metals. In most cases these are unfavourable; in special cases, however, they may well be favourable. The non-metals influence mechanical and metallurgical parameters such as corrosion resistance, hardness, dilation, conductivity, rollability, flowing property, nucleus forming property and sinterability, but also nuclear properties such as e.g. neutron capture cross-section. The concentrations in which the non-metals produce these interactions can be as low as 0.1 $\mu$g/g or even less, and extend up to 1 mg/g and more. The symposium was divided into three parts: non-metals in iron and steel; activation analysis; and non-metals in non-ferrous metals. In all 33 talks with following discussion were given, and a panel discussion held on the topic Reference materials for non-metals in metals - technical need, commercial importance, preparation and standardization. The participants were from eight European and two non-European countries.

33544 **Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation.** Johnson, A.B. Jr. (Battelle Memorial Inst., Richland, WA). *Reviews on Coatings and Corrosion ;* **1**: No. 4, 299-365(1975).

The role of nuclear fluxes in corrosion processes has been investigated in ATR, ETR, PRTR, and Hanford production reactors. The major effort was directed to zirconium alloy corrosion parameter studies. Corrosion and hydriding results are reported as a function of oxygen concentration in the coolant, flux level, alloy composition, surface pretreatment, and metallurgical condition. Localized corrosion and hydriding at sites of bonding to dissimilar metals are described. Corrosion behavior on specimens transferred from oxygenated to low-oxygen coolants in ETR and ATR experiments is compared. Mechanism studies suggest that a depression in the corrosion of the Zr-2.5 Nb alloy under irradiation is due to radiation-induced aging. The radiation-induced onset of transition on several alloys is in general a gradual process, which nucleates locally, causing areas of oxide porosity which eventually encompass the surface. Examination of Zry-2 process tubes reveals that accelerated corrosion has occurred in low-oxygen coolants. Hydrogen contents are relatively low, but show some localized profiles. Gross hydriding has occurred on process tubes containing aluminum spacers, apparently by a galvanic charging mechanism. Titanium paralleled Zry-2 in corrosion behavior under irradiation. Niobium corrosion was variable, but did not appear to be strongly influenced by radiation. Corrosion rates on Inconel and stainless steel were only slightly higher-in-flux than out-of-reactor. Corrosion rates on nickel-plated aluminum appeared to vary substantially with pre-exposure treatments, but the rates generally were accelerated compared to rates on unirradiated coupons. 59 references, 12 figures, 11 tables.

## 3602 Ceramics, Cermets, And Refractories

*REFER ALSO TO CITATION(S) 33306, 33346, 33529, 34172*

**33545 (CONF-810851—2) In-situ electron microscope fracture studies of amorphous films.** Kobayashi, S.; Ohr, S.M. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE81028141.

From 4. international conference on rapidly quenched metals; Sendai, Japan (24 Aug 1981).

The in-situ electron microscope fracture technique has been used to observe directly the propagation of cracks and the structure of the plastic zone ahead of the crack tip of amorphous films of niobium oxide.

**33546 (CONF-810856—1) Structure-property correlations for $TiB_2$-based ceramics densified using active liquid metals.** Tennery, V.J.; Finch, C.B.; Yust, C.S.; Clark, G.W. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 28p. NTIS, PC A03/MF A01. Order Number DE81028069.

From International conference on the science of hard materials; Moran, WY, USA (23 Aug 1981).

It was demonstrated that $TiB_2$ powders can be sintered to near theoretical density with modest hot-pressing procedures when prescribed diboride particle sizes are used in conjunction with liquid sintering activation agents based on metals such as Ni. An important feature of the process which permits high sintered densities is exudation of excess Ni-rich liquid before porosity becomes isolated. Microcompositional data obtained from electron microscopy and the microstructural data indicate that nickel forms a liquid during hot pressing, and that some of the $TiB_2$ dissolves in the liquid to promote rapid diffusive transport of both Ti and B throughout the microstructure. Under optimum conditions, the $TiB_2$ particles essentially maintain their original size; the grain growth and microcracking characteristic of typical $TiB_2$ ceramics is, therefore, avoided. The flexure strength of the $TiB_2$ ceramics is about 750 MPa, but can be more than 850 MPa. The fracture toughness ranges between 6 and 8 MPa m/sup 1/2/. The Young modulus, Poisson ratio DPH and thermal diffusivity of ceramics densified using Ni-rich agents are the same as that for pure $TiB_2$. Experimental TiB cutting tools fabricated with Ni-rich sintering agents, performed well compared with commercial WC-Co based tools. 10 figures.

**33547 (EPRI-AP—1955) Design of refractories for resistance to high-temperature erosion-corrosion. Final report.** Andersson, C.A.; Ranadive, A.Y.; Vojnovich, T. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Jul 1981. 149p. NTIS, PC A07/MF A01. Order Number DE81904208.

Westinghouse has developed a theory describing erosion of refractory walls in pneumatic flow and has examined the theory in laboratory studies. The research program included modeling of wall erosion, particle motion, and collisions in pneumatic flow; and measurement of particle/wall collisions, wall erosions rates and particle attrition in pneumatic transport of solids. Investigators formulated a model that relates the kinetic energies of striking particles to the fracture energies of wall materials using three failure criteria. The model relates effects of easily measurable quantities and properties to erosion. They began development of a flow-conditions model by filming particles in pneumatic flow with a high-speed movie camera. Analysis of the film showed the mechanism causing particles to strike the tube walls. This led to a flow-conditions model relating wall collision flux of particles to the conditions of flow and system geometry. Actual collision rates were measured in pneumatic flow by application of an accelerometer sensor. A principal part of this program was measurement of the erosion rates of eight refractories with various eroding particle materials, at room temperature and at high temperatures. Investigators performed the tests in a large recirculating pneumatic tube, with high temperatures provided by a natural gas burner. Test materials were shaped into hollow cylinders and stacked to form the flow tube. Results of the erosion tests provided the unknown coefficients in the erosion model and identified the mode of particle attrition in pneumatic flow. From the erosion tests they developed recommendations and guidelines for application and design of refractories under conditions of erosion and corrosion.

**33548 (LBL—11883) Indentation and erosion of brittle materials.** Khatibloo, M.A. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 163p. NTIS, PC A08/MF A01. Order Number DE81030351.

Thesis.

This work deals with the indentation and erosion of brittle materials. After a review of the extensive literature on both static indentation and low velocity impacts with round particles, no completely satisfactory explantation was found for the apparent increase in the strength of brittle materials as the indenter radius is decreased. As a starting point, the mechanical behavior of brittle materials was studied and their various responses to loading were classified. The response can be elastic, elastic-plastic or completely plastic depending on the structure and bonding type of the material as well as the shape and size of the indenter. Plasticity occurs whenever sharp or very small indenters are used. In this case, it was found that the idealization of plastic deformation by an expanding cavity concept is a satisfactory one. A model using this approach showed that cracks refered to as median vent, radial and multiple cone cracks initiate and propagate along paths close to the principal stress trajectories in the uncracked solid. On the other hand, this model can give only the initiation locations of lateral cracks. A prediction of the crack trajectories in this case appears to require additional analysis. 84 references.

**33549 (MLM—2850) Manganese glass-molybdenum metallized and copper brazed 99.5% alumina ceramics.** White, K. (Mound Facility, Miamisburg, OH (USA)). 22 Jul 1981. Contract AC04-76DP00053. 80p. NTIS, PC A05/MF A01. Order Number DE81030423.

The seal strength of manganese glass-molybdenum metallized and copper brazed 99.5% alumina ceramics was studied as a function of the glass composition, the molybdenum content of the metallizing paint, and the metallizing temperature. Interactions of individual paint constituents with 99.5% alumina ceramic were also examined and related to the sealing mechanism. The paints made of galsses with high MnO content were found to produce excellent bonding strength at a ~ 1300°C metallizing temperature. The paints containing 70 vol % molybdenum exhibited the most consistent and the highest seal strengths.

**33550 (SAND—81-0064C) Toughening in glass ceramics through microstructural design.** Mecholsky, J.J. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 16p. (CONF-810746—2). NTIS, PC A02/MF A01. Order Number DE81030209.

From International symposium on the fracture mechanics of ceramics; University Park, PA, USA (15 Jul 1981).

Pertinent literature is reviewed to establish the effect of several material parameters on fracture toughness, K/sub IC/, of glass ceramics. Important parameters include phase separation in glass, size, shape and quantity of the crystalline phase, and internal stress. By applying toughening mechanisms established for ceramic materials to glass ceramic systems, techniques for toughening glass ceramics are developed: phase separation, internal stress, morphological interaction, stress induced phase transformation, and combinations of these techniques.

**33551 (ORNL-tr—4766) Effects of binder on the properties of $TiB_2$ based cermets.** Watanabe, T.; Ishibai, K. Translated from *Funtai Oyobi Funmatsuyakin ;* **26**: No. 8, 304-309(Nov 1979). 16p. NTIS, PC A02/MF A01. Order Number DE81027615.

This paper describes the effect of binder on properties of $TiB_2$ based cermets. The used binders are $Ni_4B_3$, Co-Cr-B alloy, WB, Mo, NbB, TaB, NiB, CrB, CoB, $AlB_2$, $TaB_2$, $AlB_2$-Ni.P, $TaB_2$-Ni.P, $CrB_2$-Ni.P, $ZrB_2$-Ni.P W-Ni-P, and Mo-Ni.P. The results are as follows: $Ni_4B_3$ and NiB are good binders for $TiB_2$ based cermets; $TiB_2$-10%$CrB_2$-1%Ni.P sintered compact has the bending strength of 40 ~ 56 kg/mm$^2$ and is almost free of pores; $TiB_2$-10%CoB and $TiB_2$-5%Mo-1%Ni.P sintered compact has the bending strength of 50 ~ 60 kg/mm$^2$.

## 3604 Polymers And Plastics

*REFER ALSO TO CITATION(S) 33069*

**33552 (SAND—81-0786C) Electrical conductivity and thermal decomposition of high temperature phenolic- and silicone-based materials.** Johnson, R.T. Jr.; Biefeld, R.M. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 22p. (CONF-811016—1). NTIS, PC A02/MF A01. Order Number DE81023177.

From Conference on electrical insulation and dielectric phenomena; Whitehaven, PA, USA (25 Oct 1981).

The temperature dependence of the electrical conductivity and thermal decomposition characterisitcs of several phenolic and silicone resins reinforced with glass chopped fabric or cloth have been measured to 600 to 700°C in a nitrogen atmosphere. The electrical results are correlated with mass loss and thermal decomposition product data obtained using mass spectroscopy and thermal gravimetric analysis. Peaks in the conductivity temperature dependence and deviations from ohmic behavior are found to be associated with material decomposition and/or outgassing. Results show a direct correlation between thermal stability and temperature dependent electrical characteristics.

**33553 Effects of inhibitors on the thermal polymerization of β-pinene.** Adur, A.M.; Williams, F. (Univ. of Tennessee, Knoxville). *Journal of Polymer Science, Polymer Letters Edition ;* **19**: 53-57(1981).

Kennedy and Chou have recently reported the thermal polymerization of β-pinene, their method of preparation consisting of heating the monomer in a sealed glass vial for a week at 160°C. They reported the formation of a crystalline polymer. All attempts to increase the rate of polymerization or the conversion by adding various chemicals such as cumene peroxide, aluminum trichloride, distilled water, and bis(triphenylphosphine) rhodium carbonyl chloride, were unsuccessful. They also were unable to reach any conclusion as to the mechanism of the polymerization. This paper reports the effect of other additives on the thermal polymerization of β-pinene carried out under similar conditions to those used by the previous workers, and sheds light on the mechanism.

**33554 Nonlinear theory of viscoelasticity for application to elastomers.** Christensen, R.M. (Lawrence Livermore Lab, Calif). *American Society of Mechanical Engineers, [Paper] ;* No. 80-WA/APM-18, vp(1980).

A simple nonlinear theory of viscoelasticity has been developed for application to elastomers. The theory is the viscoelastic generalization of the kinetic theory of rubber elasticity, and it is used to model time and rate-dependent effects. The method of derivation reveals that the theory is applicable to stress-imposed rather than strain-imposed conditions. Thus the creep test provides the logical means for deducing the material properties of the theory, while the relaxation-test technique is not applicable. 9 refs.

## 3606 Other Materials

*REFER ALSO TO CITATION(S) 33041, 33372, 33372, 33521, 34045*

**33555 (BDX—613-2645) Stress relaxation of cellular silicone material: 1981.** Schneider, J.W. (Bendix Corp., Kansas City, MO (USA)). Sep 1981. Contract AC04-76DP00613. 21p. NTIS, PC A02/MF A01. Order Number DE81030692.

The long-term (10 years) stress relaxation properties of cellular silicone materials at room temperature are under evaluation. Both equilibrium (Union Carbide W-97, random copolymer) and condensation (Union Carbide Y-3976, block copolymer) type base polymers are included. Each material was compounded to yield densities of 0.34 and 0.52 g/cm$^3$ for thicknesses of 1.17, 1.52, and 2.54 mm. These density-thickness combinations were compressed to nominal compressions of 20 and 40 percent with nine replicates at each condition. A specially-designed fixture is used to maintain a specific compression on the cellular sample and a universal test machine is used to acquire the load data. Currently, the predicted load retention is between 58 and 66 percent of the original load.

**33556 (CONF-810801—57) Finite-element program for creep analysis of concrete structures.** Bazant, Z.P.; Rossow, E.C.; Horrigmoe, G. (Oak Ridge National Lab., TN (USA); Northwestern Univ., Evanston, IL (USA). Dept. of Civil Engineering). 1981. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01. Order Number DE81028071.

From 6. international conference on structural mechanics in reactor technology; Paris, France (17 Aug 1981).

Portions of document are illegible.

A new finite element program for the analysis of creep effects in concrete structures, developed at Northwestern University, is briefly described. The program represents an extension of the general purpose finite element code NONSAP developed at University of California at Berkeley. The program uses a rate type creep law based on expanding the relaxation function in Dirichlet series. The creep law is linear, the aging is accounted for, and the temperature effects on creep rate as well as the rate of aging are considered. Material properties can be input either as empirical creep test data or as the double power law for creep. The program can automatically set up the creep parameter from partial empirical information. The program uses a step-by-step integration in time. Applications are envisaged chiefly for nuclear concrete structures.

**33557 (DOE/ER/01198—1354) Phonons in graphite intercalation compounds measured by neutron scattering.** Magerl, A.; Zabel, H. (Illinois Univ., Urbana (USA); Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). 1981. Contract AC02-76ER01198. 8p. (CONF-810758—1). NTIS, PC A02/MF A01. Order Number DE81029681.

From Conference on physics of intercalation compounds; Trieste, Italy (6 Jul 1981).

The entire phonon dispersion of a solid can be measured by neutron scattering under favorable conditions. In particular, triple axis spectroscopy allows the phonon energies to be determined for a chosen polarization at well defined wave vectors q throughout the Brillouin zone (BZ). For an unambiguous assignment of the excitations, single crystals have to be available. However, in the case of graphite a complete measurement of the phonon dispersion is not possible because of the limited size of (natural) single crystals, and because of the high energy (~ 200 meV) of some branches. Therefore, only a limited amount of neutron data have been collected with pyrolytic graphite (PG). The high energy branch of stage 3 K together with complete [001]L dispersions for stage 2 K, Rb and Cs and stage 1 K and Cs are presented for the first time. It is shown that a BvK formalism is inappropriate to model the [001]L dispersion of AGIC's (with the exception of stage 1 Rb). However, including an interaction with an electronic layer between alkali and bonding graphite planes results in a shell model, which can consistently describe the measurements for all compounds.

**33558 (DOE/ER/01198—1367) Devitrification kinetics of cadmium-germanium-arsenide glasses.** Speyer, R.F. (Illinois Univ., Urbana (USA)). 1980. Contract AC02-76ER01198. 66p. NTIS, PC A04/MF A01. Order Number DE81030944.

Thesis.

Bulk $CdGeAs_2$ glasses were prepared by quenching homogenized melts in evacuated fused silica tubes. The kinetics of crystallization of these glasses were studied by thermal analysis (DSC) using the isothermal method. The fraction crystallized and heat released at various crystallization temperatures was evaluated with x-ray diffraction peak height analysis and DSC partial peak area analysis. Expressions were derived to allow calculation of crystal growth rates from the fraction crystallized and nucleation rate data. The activation energy of crystallization of this alloy was established by both the isothermal hold and heating rate methods in addition to a direct fit to the Avrami equation. An experimental procedure is described for establishing surface crystal growth rates in these glasses using a 50 Watt CW $CO_2$ laser. Microstructures of the glass before and after heat treatments by conventional and laser techniques are presented.

33559 **(IS-M—329) Some thermoelectric properties of the light rare earth sesquiselenides ($R_2Se$/sub 3-x/).** Takeshita, T.; Beaudry, B.J.; Gschneidner, K.A. Jr. (Ames Lab., IA (USA)). 1981. Contract W-7405-ENG-82. 5p. (CONF-810812—29). NTIS, PC A02/MF A01. Order Number DE81025526.

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Rare earth sesquiselenides of the $Th_3P_4$ structure show variable electric properties over their homogeneity range, i.e., ranging from metallic ($R_3Se_4$) to semimetallic ($R_2Se$/sub 3-x/, where $0.14 > x > 0$) to semiconducting ($R_2Se_3$). The composition change is due to the formation of metal vacancies in the $Th_3P_4$ structure with no vacancies at $R_3Se_4$ and 4.75 at. % vacancies at $R_2Se_3$. The rare earth sesquiselenides are also refractory materials and therefore are of interest for high temperature thermoelectric applications. Preliminary results of thermoelectric power and electrical resistivity measurements on the light lanthanide sesquiselenides (La through Sm) are presented.

33560 **(SAND—81-0786) High temperature electrical conductivity and thermal decomposition of phenolic- and silicon-based dielectrics for fireset housings.** Johnson, R.T. Jr.; Biefeld, R.M. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 67p. NTIS, PC A04/MF A01. Order Number DE81031919.

The temperature dependence of the electrical conductivity and thermal decomposition characteristics of several phenolic- and silicone-based materials of interest for fireset case housings have been measured to 600 to 700°C. The materials are phenolic or silicone resins reinforced with glass chopped fabric or cloth. The conductivity temperature dependence was measured during decomposition in a nitrogen atmosphere at a heating rate of ~ 10°C/minute. Applied electric fields were from $4 \times 10^2$ to $4 \times 10^3$ volts/cm. Thermal decomposition characteristics were investigated by mass spectroscopy in vacuum and thermal gravimetric analysis in nitrogen and air. Nearly ohmic voltage-current characteristics were obtained, except where decomposition and/or outgassing was pronounced.

33561 **(SAND—81-1834C) Effects of ion implantation on the photoferroelectric properties of lead lanthanum zirconate titanate ceramics.** Land, C.E.; Peercy, P.S. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 4p. (CONF-810863—1). NTIS, PC A02/MF A01. Order Number DE81028386.

From 5. international meeting on ferroelectricity; University Park, PA, USA (17 Aug 1981).

Earlier studies of Ar-, Ar + Ne- and Ar + Ne + He- implanted ferroelectric-phase lead lanthanum zirconate titanate (PLZT) ceramics indicate that ion implantation can increase the intrinsic (near-uv) photoferroelectric sensitivity by more than four orders of magnitude compared to that of unimplanted PLZT. More recent studies involving implantation of chemically active ions, e.g., Al and Cr, indicate that the absorption spectrum of the implanted region can be extended from the near-uv to the visible, and that the extrinsic (visible-light) photoferroelectric sensitivity can be improved substantially with respect to that of PLZT implanted with inert ions. The results of these studies are reviewed and photographic sensitivities of Ar-, Ar + Ne-, Ar + Ne + He-, Al-, Cr-, Fe-, and Fe + Ne- implanted PLZT at both near-uv and visible-light wavelengths are compared with the sensitivities of other image storage media.

33562 **(TES—32075-107) Advanced selenide thermoelectric development program. Final report.** Seetoo, W.R. (Teledyne Energy Systems, Timonium, MD (USA)). 20 Jul 1981. Contract AC01-80ET32075. 40p. NTIS, PC A03/MF A01. Order Number DE81027823.

The primary objective of this work was to demonstrate that copper silver selenide and TAGS could be segmented. The hot junction temperature was planned to be 725°C with the segmentation temperature at 400°C, both temperatures were selected to prevent excessive sublimation from the hot ends of the segments, respectively. The program was planned as a cooperative effort between General Atomic company and Teledyne Energy Systems. Accordingly, General Atomic synthesized the CuAgSe that was used to fabricate the test hardware that was ultimately delivered to General Atomic for testing. Both the CuAgSe and TAGS were hot pressed in an argon atmosphere then the segments were furnace-bonded to each other. A secondary objective was to produce CuAgSe powder by rapid solidification.

33563 **(UCRL—15373) Antireflecting film development. Final report.** Hahs, T.S. (Owens-Illinois, Inc., Toledo, OH (USA). Corporate Technology Div.). 11 May 1981. Contract W-7405-ENG-48. 13p. NTIS, PC A02/MF A01. Order Number DE81030010.

A metal-organic precursor was formulated that is converted by heating on surfaces of ordinary glass to a phase-separated metal-organic-derived glass coating, without exceeding 375°C. This phase-separated layer is quickly and easily leached by nitric acid to leave a graded index, antireflective coating on ordinary glass (e.g., BK-7 optical glass or fused silica) that protects it against damage by high fluence of laser light at 1060 nm and shorter wavelengths. The metal-organic precursor is relatively inexpensive, and the thickness applied to the glass surface is not very critical for the achievement of protection for the glass surface from 1 ns pulses of laser energy. Laser damage testing at 248 nm with this coating on silica discs was thought to show separation of the coating from the substrate at fluences as low as 1.2 J/cm² with fracture damage at 4.9 J/cm². These tests results provide a criterion we lacked. If laser damage tests could be performed promptly, we recommend treatments that should strengthen the union of coating to substrate.

33564 **(UCRL—15375) Development of uv-transparent fluorophosphate glass. Final report, July 10, 1980-January 10, 1981.** Cook, L.M. (Lawrence Livermore National Lab., CA (USA); Schott Optical Glass, Inc., Duryea, PA (USA)). 1981. Contract W-7405-ENG-48. 40p. NTIS, PC A03/MF A01. Order Number DE81030065.

It was demonstrated that FK-54 fluorophosphate glass of high uv transparency may be prepared using clean raw materials in an inert system. Absorbance at 248 nm was reduced from 1.5 $cm^{-1}$ in commercial FK-54 to 0.111 $cm^{-1}$ in 1.5 L capacity test melts prepared in carbon crucibles. The effects on uv absorbance of a number of raw material contaminants were evaluated and several methods of beneficiation and clean raw material preparation were tested. The most successful production process was evaluated and scaled up from 0.35 L to 1.5 L capacity melting. Methods for storage and handling of very clean raw materals were proposed. Finally, the major limitations on the use of FK-54 as a window material for 248 nm laser systems have been identified as the lack of sufficiently clear raw materials to enable rational production of glass having very low absorbance, and the tendency of the glass to solarize when exposed to high intensity uv illumination.

33565 **Use of V/sub OC//J/suc SC/ measurements for determination of barrier height under illumination and for fill-factor calculations in Schottky-barrier solar cells.** Panayotatos, P.; Card, H.C. (Columbia Univ, New York, NY). *IEE (Institution of Electrical Engineers) Proceedings, Part I: Solid-State and Electron Devices ;* **127**: No. 6, 308-311(Dec 1980).

An experimental study has been made of metal-silicon solar cells, with thin Ag, Au, Cu, Fe and In electrodes. No intentional interfacial layers were introduced and the silicon surfaces were chemically prepared in such a way as to minimize the residual oxide layer. The characteristics of the devices were taken at various illumination levels and the effect of barrier height, series resistance and n-value on the open-circuit voltage and the fill factor were studied. Comparison between theoretical predictions and the experimental results show that V/sub OC//J/sub SC/ measurements that provide the n-values appropriate for the expression for the open-circuit voltage also provide a method for experimental barrier-height determination under illumination and that the above 'true' n-value should also be used in fill-factor calculations. 14 refs.

33566 **Coherent multilayer crystals and method of making.** Schuller, I.K.; Falco, C.M. (to Dept. of Energy). US Patent Application 202,083. 30 Oct 1980. 16p.

A new material is described consisting of a coherent multilayer crystal of two or more elements where each layer is composed of a single element. Each layer may vary in thickness from

about 2 A to 2500 A. The multilayer crystals are prepared by sputter deposition under conditions which slow the sputtered atoms to near substrate temperatures before they contact the substrate.

**33567 Apparatus for electroplating particles of small dimension.** Yu, C.M.; Illige, J.D. US Patent Application 188,791. 19 Sep 1980. 20p.

The thickness, uniformity, and surface smoothness requirements for surface coatings of glass microspheres for use as targets for laser fusion research are critical. Because of thier minute size, the microspheres are difficult to manipulate and control in electroplating systems. The electroplating apparatus of the present invention addresses these problems by providing a cathode cell having a cell chamber, a cathode and an anode electrically isolated from each other and connected to an electrical power source. During the plating process, the cathode is controllably vibrated along with solution pulse to maintain the particles in random free motion so as to attain the desired properties.

**33568 Threshold voltage for damage in Si under electron bombardment.** Fraser, H.L. (Univ. of Illinois, Urbana). Contract E(11-1)-1198. *Scripta Metallurgica ;* **11**: No. 1, 47-49(Jan 1977).

Prolonged irradiation (~ 60 minutes) at accelerating voltages of 100, 150 and 175 kV produced no observable damage in the foils. However, at an accelerating voltage of 200 kV, dislocation loops were observed associated with the stacking faults.

# 40 CHEMISTRY

*REFER ALSO TO CITATION(S) 33496*

**33569** (LBL—12000, pp 229-333) **Fundamental interactions.** Somorjai, G.A. Jun 1981. NTIS, PC A24/MF A01. Order Number DE81027828.

In Materials and Molecular Research Division annual report 1980.

Topics studied were in photon-assisted surface reactions, photochemistry of materials in the stratosphere, energy transfer to molecules on surfaces, molecular beam spectroscopy, selective photochemistry, thermodynamic properties, chemical dynamics, theory of low-energy atomic and molecular collision processes, photoelectron spectroscopy, crossed molecular beams, potential energy surfaces for chemical reactions, picosecond laser excitation of chemical reactions, and atomic physics. (DLC)

## 4001 Analytical And Separations Chemistry

*REFER ALSO TO CITATION(S) 32832, 32833, 32833, 32861, 32932, 33002, 33002, 33004, 33004, 33007, 33008, 33009, 33010, 33011, 33012, 33036, 33036, 33036, 33059, 33060, 33728, 33729, 33730, 33731, 33732, 33733, 33734, 33735, 33736, 33737, 33746, 33746, 33750, 33754, 33755, 33756, 33773, 33775, 33776, 33777, 33778, 33779, 33780, 33781, 33782, 33784, 33785, 33786, 33787, 33788, 33789, 33790, 33791, 33792, 33793, 33800, 33806, 33809, 33810, 33812, 33813, 33814, 33815, 33816, 33817, 33818, 33825, 33838, 33844, 33866, 33867, 33868, 33869, 33878, 33879, 33880, 33883, 33884, 33905, 33906, 33907, 33914*

**33570** (CONF-800433—, pp 332-336) **Error-free binary dilution method for the preparation of ppB-level liquid standards.** Wiernik, M. (State Univ. of Campinas, Brazil). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The ways that ppB-level standard solution are normally prepared and their accompanying errors are studied. A new binary method of dilution that is theoretically error-free is described.

**33571 Ion chromatography with low-capacity resins and low-conductivity eluents.** Gjerde, D.T. Ames, IA; Iowa State Univ. (1980). 167p. University Microfilms Order No. 80-28,615.

Thesis (Ph. D.).

Strong-base anion exchangers with capacities ranging from 0.04 to 1.46 mequiv./g and from 0.0016 to 0.024 mequiv./g are prepared from Amberlite XAD resins. Distribution ratios of common inorganic and organic anions decrease with decreasing resin capacity, but selectivity coefficients are essentially constant for most of the anions studied. The effect of resin capacity on the distribution ratios for some of the metals that form anionic chloro complexes is also studied. The low-capacity resins are shown to be useful for practical chromatographic separations of mixtures containing palladium(II), platinum(IV), gold(III), bismuth(III) and mercury(II). A new and simple system of anion chromatography is described for the separation and determination of inorganic and organic anions. The anions are separated on a column containing a macroporous anion-exchange resin of a low capacity (0.007 to 0.07 mequiv./g). Only a dilute solution of an aromatic organic acid salt is needed as the eluent. The eluent conductance is sufficiently low so that a suppressor column is not needed and the separated anions can be detected with a simple conductance detector. Numerous examples of actual separations are shown. In some cases, concentrations of anions below 1 ppM could be detected. Equations are developed to help separate difficult mixtures of anions. A system of cation chromatography is described in which metal and ammonium ions are separated on a cation-exchange column of low capacity and are detected with a conductivity detector. No suppressor column is needed. A nitric acid eluent is used to separate mixtures of alkali metal and ammonium ions, and an eluent containing an ethylenediammonium salt is used for the separation of alkaline earth metal ions. The new method is used to determine sodium, potassium, ammonium, magnesium, and calcium in drinking water.

**33572 (DP—1577) Recovery of americium-241 from aged plutonium metal.** Gray, L.W.; Burney, G.A.; Reilly, T.A.; Wilson, T.W.; McKibben, J.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Dec 1980. Contract AC09-76SR00001. 43p. NTIS, PC A03/MF A01. Order Number DE81030751.

About 5 kg of ingrown $^{241}Am$ was recovered from 850 kg of aged plutonium using a process developed specifically for Savannah River Plant application. The aged plutonium metal was first dissolved in sulfamic acid. Sodium nitrite was added to oxidize the plutonium to Pu(IV) and the residual sulfamate ion was oxidized to nitrogen gas and sulfate. The plutonium and americium were separated by one cycle of solvent extraction. The recovered products were subsequently purified by cation exchange chromatography, precipitated as oxalates, and calcined to the oxides. Plutonium processng was routine. Before cation exchange purification, the aqueous americium solution from solvent extraction was concentrated and stripped of nitric acid. More than 98% of the $^{241}Am$ was then recovered from the cation exchange column where it was effectively decontaminated from all major impurities except nickel and chromium. This partially purified product solution was concentrated further by evaporation and then denitrated by reaction with formic acid. Individual batches of americium oxalate were then precipitated, filtered, washed, and calcined. About 98.5% of the americium was recovered. The final product purity averaged 98% $^{241}AmO_2$; residual impurities were primarily lead and nickel.

**33573 (EPRI-CS—1958) Neutron-activation analysis of turbine deposits. Interim report.** (Consolidated Controls Corp., Bethel, CT (USA)). Aug 1981. 65p. NTIS, PC A04/MF A01. Order Number DE81904189.

The basic design of a nonintrusive system employing the associated-particle time-of-flight technique to detect the inelastic-gamma rays induced by 14 MeV neutrons incident upon corrodent elements deposited upon the blades of an operating steam or combustion turbine was determined. Measurements of steam and combustion turbine blades with simulated corrodent chemicals demonstrated that deposits of $Na_2SO_3$, NaCl, and $Na_2PO_4$ as small as $10^{-3}$ g/cm$^2$ could be detected by this technique with a neutron source strength of $10^7$ n/s and an exposure time of approximately $10^4$ seconds.

**33574 (IS-T—898) Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry.** Houk, R.S. (Ames Lab., IA (USA)). 1980. Contract W-7405-ENG-82. 131p. NTIS, PC A07/MF A01. Order Number DE81030744.

Thesis.

Aerosols of trace elements in solution are injected into an inductively coupled argon plasma to generate a relatively high

number density of positive ions derived from the trace elements. A small fraction of these ions is extracted through a pinhole sampling orifice into a differentially pumped vacuum system housing an ion lens and quadrupole mass spectrometer. The positive ion mass spectrum obtained during nebulization of the solvent (1% $HNO_3$ in $H_2O$) consists essentially of $ArH^+$, $Ar^+$, $H_3O^+$, $H_2O^+$, $NO^+$, $O_2^+$, $HO^+$, $Ar_2^+$, $Ar_2H^+$, and $Ar^{+2}$. Thus there are few potential interferences from solvent or argon ions above 42 u. The mass spectra of the trace elements studied consists almost entirely of singly charged monatomic ($M^+$) or oxide ($MO^+$) ions. The various isotopes of those elements studied are detected in the correct relative isotopic abundances. Several trace elements are readily detected in a mass spectrometer scanning mode at 0.05 μg/mL. Analytical calibration curves obtained in a single ion mode are linear over nearly four orders of magnitude with detection limits of 0.001 to 0.01 μg/mL for those elements studied. Rapid sample throughput, direct introduction of solutions, and the capability of direct isotopic determination of trace elements are among the attractive features of this new analytical approach.

**33575 (IS-T—914) Liquid-liquid chromatography fractionation of organic compounds in complex mixtures: application to automobile exhaust.** Colgrove, S.G. (Ames Lab., IA (USA)). 1980. Contract W-7405-ENG-82. 304p. NTIS, PC A14/MF A01. Order Number DE81030743.

Thesis.

A liquid-liquid fractionation method based upon well-known chemical reactions has been developed. With the use of the fractionation method, a mixture of organic compounds can be separated into strong acid, weak acid, base, aldehyde, ketone, polar, and nonpolar fractions. Organic compounds, representing several chemical classes, were used to determine how much material would be lost during the fractionation and to determine how well the various compound types could be separated from each other. Most of the compounds tested were recovered in yields which were sufficient to provide good qualitative and quantitative data. Problems relating to impurities introduced into samples by solvents and reagents were examined. In addition, some reactions which led to the formation of artifacts were investigated. The advantages of using the liquid-liquid fractionation method as a pre-separation method for GC/MS were shown for the analysis of real samples, including gasoline, diesel fuel, and exhaust from internal combustion engines using those fuels.

**33576 (K/OA—5014-Rev.1) Gamma-ray spectrometric determination of $UF_6$ assay with 1 percent precision for international safeguards. Part 1. Product and feed in 1S and 2S sample cylinders.** Ricci, E. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1 Sep 1981. Contract W-7405-ENG-26. 24p. NTIS, PC A02/MF A01. Order Number DE81030818.

A rapid gamma-ray spectrometric (non-destructive) method is described which can determine $^{235}U$ enrichment with a relative precision of 1 percent (or less) in $UF_6$ contained in 1S and 2S bottles. The method is based on counting the 186 keV gamma rays emitted by $^{235}U$ using a Pb-collimated Ge(Li) detector. The gamma-ray count rate, corrected for cylinder wall (nickel) attenuation, is converted to $^{235}U$ assay by comparison with standards. Measurements of fifty $UF_6$ product and feed cylinders reveal the following precisions (i.e., percent relative standard deviations) which correspond to the counting times given in parenthesis: Product - 2S, 0.98 percent (600 sec); Feed - 2S, 0.48 percent (2500 sec); Product - 1S, 0.62 percent (1000 sec); Feed - 1S, 0.73 percent (3000 sec). A 1 percent precision is desired for the attributes verification measurements of the $^{235}U$ concentration for $UF_6$ in sample cylinders. Such attributes measurements comprise part of a material-balance verification strategy that can be carried out by the International Atomic Energy Agency (IAEA) during safeguards inspections at uranium enrichment facilities. Although the precision of the above results is satisfactory, the average relative differences between gamma-ray and mass-spectrometric determinations for the last two sets of measurements (1S cylinders) have positive biases. Research and development work is underway to understand and correct these biases. Also, a series of measurements of $UF_6$ tails in 1S and 2S bottles are currently being performed and evaluated.

**33577 (LA—8957-MS) User's guide to the hydrogen monitor.** Meier, M.M.; Adams, E.L. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 22p. NTIS, PC A02/MF A01. Order Number DE81032023.

A protocol for calibration of the hydrogen monitor and for its use as an assay instrument is presented. A statistical analysis for the system, including effects of deadtime and pile-up loss, is developed, and the software that supports the system is described.

**33578 (LA-UR—81-2531) Instrument for liquids, amorphous and power diffraction.** Soper, A.K. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 13p. (CONF-810840—4). NTIS, PC A02/MF A01. Order Number DE81030135.

From Symposium on neutron scattering; Argonne, IL, USA (12 Aug 1981).

A time-of-flight diffractometer, which has been built at the Los Alamos pulsed neutron source, is described. The concept of resolution focussing is discussed and the application of the instrument to liquid structure over a broad range of momentum transfers is presented.

**33579** (LBL—11986, pp 5.35-5.37) **Determination of carbon in atmospheric aerosols by deuteron-induced nuclear reactions.** Clemenson, M.; Novakov, T.; Markowitz, S. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

Nuclear reactions induced by 7.6-MeV deuterons are used to determine total carbon in atmospheric aerosols. The $^{12}C(d,n)^{13}N$ reaction produced the radionuclide $^{13}N$, a 10.0-min positron emitter which is detected by its 0.511-MeV annihilation radiation. The method is nondestructive of the sample, permitting the sample to be studied by additional methods. Comparison of carbon found by deuteron activation analysis with that found by independent but destructive combustion methods shows a standard deviation of 10% for 15 samples analyzed over a wide range of carbon contents. The detection limit is estimated to be 0.5 $\mu g/cm^2$, corresponding to a carbon concentration of 0.2% in a sample of total thickness 250 $\mu g/cm^2$.

**33580** (LBL—11986, pp 5.38-5.39) **Determination of low-Z elements simultaneously by $^3$HE-induced nuclear wastes.** McKinney, M.; Markowitz, S. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

This work is a continuation of the work of Clemenson et al. for developing rapid nondestructive techniques for determining carbon, nitrogen, and oxygen in atmospheric aerosols. Previously Clemenson et al. developed methods of determining carbon, nitrogen, and oxygen separately by activation analysis using different charged particles in different experiments. We want to develop a method for simultaneously determining carbon, nitrogen, and oxygen in atmospheric aerosols by irradiating the sample with a single particle.

**33581 (PNL-SA—9143) Precise trace rare earth analysis by radiochemical neutron activation.** Laul, J.C.; Lepel, E.A.; Weimer, W.C.; Wogman, N.A. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1981. Contract AC06-76RL01830. 19p. (CONF-8106153—1). NTIS, PC A02/MF A01. Order Number DE81030009.

From Modern trends in neutron activation conference; Toronto, Canada (5 Jun 1981).

A rare earth group separation scheme followed by normal Ge(Li), low energy photon detector (LEPD), and Ge(Li)-NaI(Tl) coincidence-noncoincidence spectrometry significantly enhances the detection sensitivity of individual rare earth elements (REE) at or below the ppB level. Based on the selected γ-ray energies, normal Ge(Li) counting is favored for $^{140}La$, $^{170}Tb$, and $^{169}Yb$; LEPD is favored for low γ-ray energies of $^{147}Nd$, $^{153}Sm$, $^{166}Ho$, and $^{169}Yb$; and noncoincidence counting is favored for $^{141}Ce$, $^{143}Ce$, $^{142}Pr$, $^{153}Sm$, $^{171}Er$, and $^{175}Yb$. The detection of radionuclides /sup 152m/Eu, $^{159}Gd$, and $^{177}Lu$ is equally sensitive by normal Ge(Li) and noncoincidence counting; $^{152}Eu$ is equally sensitive by LEPD and normal Ge(Li); and $^{153}Gd$ and $^{170}Tm$ is equally favored by all

the counting modes. Overall, noncoincidence counting is favored for most of the REE. Precise measurements of the REE were made in geological and biological standards.

**33582 High-resolution $^{113}Cd$ NMR of solids. Correlation of spectra with the molecular structure of a decanuclear cadmium(II) complex.** Murphy, P.D.; Stevens, W.C.; Cheung, T.T.P.; Lacelle, S.; Gerstein, B.C.; Kurtz, D.M. Jr. (Dept. of Energy, Ames, IA). *Journal of the American Chemical Society ;* **103**: No. 15, 4401-4404(29 Jul 1981).

The usefulness of $^{113}Cd$ NMR in solution as a structural and dynamic probe of macromolecular systems is hampered by fast exchange of $Cd^{2+}$ with ligands and solvent. This paper demonstrates that recently developed techniques for attainment of high-resoluion NMR spectra in solids can overcome this problem. These spectra provide information about $Cd^{2+}$ coordination environments which is unavailable in solution and which can be used to interpret NMR spectra in solution. By a combination of $^{113}Cd$-$^{1}H$ cross polarization and spinning either at the magic angle or slightly off magic angle, the following solid-state $^{113}Cd$ NMR data for each cadmium site in the decanuclear cation $Cd_{10}(SCH_2CH_2OH)_{16}^{4+}$ have been obtained: $\sigma$, the isotropic value of the chemical shift; $\Delta\sigma$, the shielding anisotropy; and S, a symmetry factor which characterizes the uniformity of shielding with respect to an axially symmetric tensor. The values of $\sigma$ and $\Delta\sigma$ are shown to accurately reproduce the static (nonspinning) NMR spectrum of the solid.

**33583 Precious metal analysis by controlled potential coulometry.** Harrar, J.E.; Waggoner, M.C. (Lawrence Livermore Lab., CA). *Plating and Surface Finishing ;* vp(Jan 1981).

Controlled potential coulometry is an electrochemical technique of high accuracy and precision and is especially suitable to the analysis of precious metals. Only ~ 5 mg of metal are required for each determination, and an accuracy and precision within 0.1% can be achieved routinely. The technique and its application to the analysis of gold and silver plating solutions are described. 3 figures, 3 tables.

**33584 Two-laser induced selective infrared-visible fluorescence for thin film analysis.** Richardson, J.H.; Dering, J.P.; Johnson, D.C.; Hrubesh, L.W. (Univ. of California, Livermore). Contract W-7405-ENG-48. *Analytical Chemistry ;* **52**: No. 6, 982-983(May 1980).

A laser technique has been developed to enhance its sensitivity for thin film analysis of mixtures. A c-w visible or uv laser was used to stimulate visible fluorescence from a thin fluorophor film, and a chopped low-power infrared laser was used to selectively excite characteristic infrared absorption bands in the sample. The resulting modulated visible fluorescence signal was monitored by an optical detection system. The technqiue has been applied to the quantitative determination of mixtures of coumarin 7, rubene, and rhodamine 6G; however, quantitative analysis has been impossible due to the difficulty in obtaining a uniform thin film. (BLM)

**33585 Hy-phen-ated methods.** Hirschfeld, T. (Lawrence Livermore Lab., CA). Contract W-7405-ENG-48. *Analytical Chemistry ;* **52**: No. 297A, vp(Feb 1980).

The hyphen refers to GC-MS, LC-MS, GC-IR, and other combined analytical methods, where GC = gas chromatography, MS = mass spectroscopy, etc. Such methods are needed when the number of possible compounds is large. The technology and state of art of hyphenated methods are discussed. (DLC)

**33586 Solvent extraction behavior of ruthenium I. The nitric acid-tri-n-butyl phosphate system.** Pruett, D.J. (Oak Ridge National Lab., TN (USA). Chemical Technology Div.). *Radiochimica Acta ;* **27**: No. 2, 115-120(1980).

The distribution of equilibrium mixtures of ruthenium (III) nitrosyl species between nitric acid solutions and tri-n-butyl phosphate (TBP)-n-dodecane (NDD) solution has been studied. The influence of nitric acid concentration and the addition of various small anions ($NO^-_3$,$HSO^-_3$,$Cl^-$,$F^-$, and $C_2O^{2-}_4$) to the aqueous phase on this distribution was investigated. The amount of ruthenium nitrosyl extracted into the organic phases reaches a maximum near 1 M $HNO_3$ in the absence of additional complexing or salting out reagents. Addition of a neutral nitrate salt ($NaNO_3$) increases the distribution coefficient. Addition of the sodium salts of $HSO^-_3$, $Cl^-$, and $F^-$ has little effect on the distribution, while the addition of oxalic acid substantially reduces the extraction of ruthenium nitrosyl into the organic phase. Di-n-butyl phosphate (DBP) exhibits a synergistic effect in combination with TBP, substantially increasing the ruthenium distribution coefficient.

**33587 Chromatographic separation of metal ions on macroreticular anion-exchange resins of a low capacity.** Gjerde, D.T.; Fritz, J.S. (Ames Lab., IA). Contract W-7405-ENG-82. *Journal of Chromatography ;* **188**: 391-399(1980).

The capacity of anion-exchange resins in a useful variable in devising practical analytical separations. Metal ions that form anionic chloro complexes are more weakly retained on resins of very low exchange capacity. Palladium(II), platinum(IV), gold(III), bismuth(III) and mercury(II) are retained on a column of 0.21 mequiv./g XAD-4 anion-exchange resin from 0.2 M hydrochloric acid and base metals pass through. The metals are then selectively eluted by various higher concentrations of hydrochloric acid. Batch distribution data are used to show the effect of capacity and to predict what separations are possible. 6 figures, 4 tables.

## 4002 Inorganic And Physical Chemistry

*REFER ALSO TO CITATION(S) 32878, 33073, 33074, 33192, 33612, 33620*

**33588 (CALT—767P8-8) Application of ion cyclotron resonance spectroscopy, photoionization mass spectrometry and photoelectron spectroscopy to study the properties and reactions of ions in gases.** Beauchamp, J.L. (California Inst. of Tech., Pasadena (USA)). 9 Sep 1981. Contract AI03-76ER72008. 24p. NTIS, PC A02/MF A01. Order Number DE81030296.

Ion cyclotron resonance spectroscopy was used to study the acid-base properties of molecules, photoelectron spectra of free radicals, multiphoton dissociation of molecules with low-power continuous-wave infrared laser radiation, gas-phase organometallic chemistry, and radiative association reactions. A summary of the research is given with no data. A bibliography of 156 research publications is included. (DLC)

**33589** (LBL—12000, pp 503-512) **Nuclear waste management.** Edelstein, N.M. Jun 1981. NTIS, PC A24/MF A01. Order Number DE81027828.

In Materials and Molecular Research Division annual report 1980.

Research on thermodynamic properties of chemical species in nuclear waste was conducted: convolution voltammetry of trace metal complexation (Pb-Cl system), Nd hydrolysis, separation of overlapping peaks by semidifferential electroanalysis, and solubility of $Am^{3+}$ in neutral and basic solutions. 4 figures, 3 tables.

**33590 (LBL—12986) Surface science of heterogeneous catalysis: possible applications in atmospheric sciences.** Somorjai, G.A. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 15p. (CONF-8106147—1). NTIS, PC A02/MF A01. Order Number DE81028135.

From Atmospheric chemical society conference on atmospheric sciences; Albany, NY, USA (29 Jun 1981).

Surface science has been increasingly utilized in recent years to explore the molecular details of heterogeneous catalytic processes. A large number of techniques have been developed that determine the atomic surface structure, the composition, and oxidation states in the surface monolayer. Correlations of studies of catalytic reaction rates and product distributions with atomic scale surface properties revealed many important ingredients of surface reactivity. The structure of the catalytic surface markedly influences the surface chemical bonds of adsorbed molecules. Additives which are often electron donors (alkali metals) or electron acceptors (halogens) change the oxidation state of surface atoms, block sites, or change the surface structure and markedly influence the surface reactivity. The catalyzed reactions of carbonaceous deposits and water vapor are discussed along with the possible importance of trace metals and high surface area alumina silicates in atmospheric chemistry.

**33591 (PNL-SA—9377) Crystal structure and stoichiometry of the Ca/sub 2+x/Nd/sub 8-x/(SiO$_4$)$_6$O/sub 2-1/2x/ system.** Fahey, J.A.; Weber, W.J. (Pacific Northwest Lab., Richland, WA (USA); Bronx Community Coll., New York (USA)). Jun 1981. Contract AC06-76RL01830. 5p. (CONF-810675—4). NTIS, PC A02/MF A01. Order Number DE81030079.

From 15. rare earth research conference; Rolla, MO, USA (15 Jun 1981).

A systematic study of Ca/sub 2+x/Nd/sub 8-x/(SiO$_4$)$_6$O/sub 2-1/2x/, one of the mineral-like phases formed by the rare earths in the supercalcine-ceramic nuclear waste forms, has been undertaken. Until now, the structure and stoichiometry of this apatite phase has only been inferred from the hexagonal symmetry revealed by its powder diffraction data. The goal of this study was to obtain a complete set of atomic coordinates and the temperature factor and occupation factor for each atom in this structure by applying the Rietveld profile analysis technique to powder x-ray diffraction data. Samples of several bulk compositions in the range $0 \leqq x \leqq 4$ were prepared in order to evaluate the solid solution limits of the apatite phase. The structure of $Ca_2Nd_8(SiO_4)_6O_2$ has been shown to be isostructural with $Ca_{10}(PO_4)_6F_2$. The metal ions occupying the 4f site are coordinated by six silicate oxygens at an average distance of 2.56 A. The Nd(+3) ions occupying the 6h site are coordinated by six silicate oxygens at an average distance of 2.49 A and by one anionic oxygen at 2.27 A. The anionic oxygen in 2a is coordinated by three Nd(+3) ions. The structure of $Ca_3Nd_7(SiO_4)_6O_{1.5}$ is similar except that five Nd(+3) and one Ca(+2) ions occupy the 6h site and 1/4 of the anionic oxygens are missing in a random fashion.

**33592 Queries concerning local models for hydrogen uptake in metal hydrides.** Oesterreicher, H. (Univ. of California, San Diego). *Journal of Physical Chemistry ;* **85**: No. 16, 2319-2321(6 Aug 1981).

A new prescription based on models of local environment is given for generating pressure-composition isotherms for pseudobinary metal hydrides. However, it is shown that for pseudobinaries such as Zr/sub 1-x/Ti/sub x/Mn$_2$ the amount of H uptake as a function of x around ambient conditions can be explained predominatly as a result of the $\alpha$-$\beta$ phase transition rather than by local models.

**33593 Analysis of field-dependent relaxation data and hyperfine shifts of cytochrome c' from Rhodospirillum rubrum in terms of the high-spin iron ligation states.** La Mar, G.N.; Jackson, T.; Bartsch, R.G. (Univ. of California, Davis). *Journal of the American Chemical Society ;* **103**: No. 15, 4405-4410(29 Jul 1981).

The pH and field dependence of the paramagnetic line widths of the heme methyl resonances of cytochrome c' from Rhodospirillum rubrum (strain 1 DTCC) have been analyzed for the purpose of extracting information on the ligation states of the protein in both its oxidized and its reduced high spin forms. The methyl line widths in all protein forms were found to exhibit substantial quadratic field dependence consistent with significant contribution from Curie spin relaxation. For ferricytochrome c', the field-independent contribution to the methyl line width differed substantially between the acid-to-neutral pH form (I) and form II, stable in the pH range 9 to 11. Comparison of the calculated electron relaxation times indicates that form I has a weaker axial ligand field than either form II or aquometmyoglobin, which favors a five-coordinate I and a six-coordinate II. The appearance of two new resonances in the far downfield region upon converting I $\rightarrow$ II, without the apparent loss of any hyperfine shifted signals from I, confirms the coordination of a sixth ligand in II. Qualitative comparisons of the line widths fo these two new signals to those of the heme methyls support an acidic residue as the sixth ligand. The detection of the characteristic exchangeable proton resonance of an axial imidazole and the importance of Curie spin relaxation in ferrocytochrome c' confirm its high-spin five-coordinated structure. 4 figures.

**33594 Comparative reactivities of two isoelectronic transition-metal hydrides with transition-metal carbonyls and alkyls.** Jones, W.D.; Huggins, J.M.; Bergman, R.G. (Univ. of California, Berkeley). *Journal of the American Chemical Society ;* **103**: No. 15, 4415-4423(29 Jul 1981).

The two isoelectronic hydrides $PPN^+CpV(CO)_3H^-$ (1) and $CpMo(CO)_3H$ (2) react with a variety of metal carbonyls and alkyls. Treatment of $Fe(CO)_5$, $Cr(CO)_6$, $(CH_3C_5H_4)V(CO)_4$, $CH_3Re(CO)_5$, and $(CH_3CO)Re(CO)_5$ with 1 produces $HFe(CO)_4^-$, $HCr(CO)_5^-$, $(CH_3C_5H_4)V(CO)_3H^-$, $(H)(CH_3)Re(CO)_4^-$, and $(H)(CH_3CO)Re(CO)_4^-$, respectively, and $CpV(CO)_4$ (3). 1 also catalyzes ligand substitution reactions in 3 and $CpFe(CO)(PPh_3)(COCH_3)$. In comparison 2 reacts only with $CH_3Mn(CO)_5$ and $CpMo(CO)_3R$(R = $CH_3$, $C_2H_5$, $CH_2C_6H_5$) producing aldehydes and the dimers $[CpMo(CO)_3]_2$ (4a) and $[CpMo(CO)_2]_2$ (5a). Reaction of 2 with ethylene produces ethane and diethyl ketone. 1 is proposed to react by an electron-transfer mechanism, whereas 2 is proposed to react by hydrogen transfer to a vacant coordination site. The relationship of the molybdenum hydride/alkyl reaction to the final step in hydroformylation (oxo process) is discussed.

**33595 Rate and activation enthalpy of decomposition of $CaCO_3$.** Powell, E.K.; Searcy, A.W. (Lawrence Berkeley Lab., CA). Contract W-7405-ENG-48. *Metallurgical Transactions ;* **11B**: 427-432(Sep 1980).

The heat balance during steady state decomposition of $CaCO_3$ single crystals in vacuum is analyzed. It is shown that, contrary to the contention of others, the rate of decomposition of $CaCO_3$ can be measured under conditions which make the slowest chemical step of the process, rather than heat transfer or gas phase diffusion, rate limiting. From new experimental measurements and measurements of previous investigators the apparent enthalpy of activation for $CaCO_3$ decomposition (when the $CO_2$ background pressure is negligible) is found to be 50 +- 3 kcal (calculated in terms of pressures equivalent to the $CO_2$ decomposition flux densities), compared to 40.5 kcal for the equilibrium decomposition reaction. The rates of decomposition of single crystals which are measured in different studies differ by as much as a factor of 4, but average only about $10^{-5}$ times the flux densities that are theoretically achievable for the reaction. 3 figures, 1 table.

**33596 Ammonium iodide-potassium iodide mixed crystals in equilibrium with aqueous and aqueous-2-propanol solutions.** Richards, R.R.; Young, S.L.; Gebert, E.; Schreiner, F.; Appelman, E.H. (Argonne National Lab., IL). *Journal of Chemical and Engineering Data ;* **25**: No. 2, 161-163(Apr 1980).

The equilibria in the systems KI + $NH_4I$ + water and KI + $NH_4I$ + equimolar mixtures of 2-propanol and water have been studied at 25°C. The two iodides are completely miscible in the solid phase.

**33597 Catalytic decomposition of potassium perchlorate.** Collins, L.W. (Mound Facility, Miamisburg, OH). Contract AC04-76-DP00053. *Inorganica Chimica Acta ;* **39**: 53-56(1980).

The thermal decomposition of potassium perchlorate in the presence of various metal oxides was investigated by thermogravimetry and by isothermal weight loss techniques. The effect of metal oxide concentration on the temperature of initial deflection, T/sub i/, of thermogravimetry curves of metal oxide/potassium perchlorate mixtures was determined. The Arrhenius parameters were also tabulated to demonstrate the effect of metal oxide concentration on the rate of decomposition of the potassium perchlorate. 2 figures, 1 table.

**33598 Rate of reaction of superoxide radical with chloride-containing species.** Long, C.A.; Bielski, B.H.J. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry ;* **84**: 555-557(1980).

This paper evaluates the rate constants for the reaction of superoxide radical with five common chloride-containing species ($Cl^-$, $ClO^-$, $ClO_2^-$, $ClO_3^-$, and $ClO_4^-$ and proposes a mechanism for those which react.

**33599 Contribution of light scattering to the circular dichroism of deoxyribonucleic acid films, deoxyribonucleic acid-polylysine complexes, and deoxyribonucleic acid particles in ethanolic buffers.** Maestre, M.F.; Reich, C. (Univ. of California, Berkeley). Contract W-7405-ENG-48. *Biochemistry ;* **19**: 5214-5223(1980).

The contribution of scattering to the circular dichroism (CD) of DNA films with twisted structures, DNA-polylysine complexes, and condensed DNA aggregates in ethanolic buffers of defined salt concentrations has been studied by the use of novel measuring techniques. These techniques include fluorscat cuvettes, fluorescence-detected circular dichroism (FDCD) methods, backscattering capturing devices, and beam-mounted goniometer detectors. The result of the experimental measurement is that DNA films can be made which have very large ellipticities or CD at sharp specific wavelengths. The sign of these ellipticities is related to the handedness of the twists, with a right-handed twist producing large positive rotations and a left-handed one producing negative rotations. The film shows nodal angles at which the interaction with light is minimal. The scattering patterns of both films, DNA-polylysine particles and DNA-EtOH condensates, show that the main interaction is light scattering produced by a resonance phenomenon similar to that produced in cholestric liquid crystals and twisted-nematic liquid crystals. It is proposed that the so-called psi-type CD spectrum is a manifestation of a side-by-side packing of DNA molecules with a long-range twisting order whose helical parameters match the helical parameter of circularly polarized light at specific resonance or critical wavelengths. Application of the Bragg law for cholesteric liquid crystals gives the periodicity of the long-range ordered structures. 9 figures.

**33600 New techniques in atomic and molecular laser spectroscopy.** Steenhoek, L.E. Ames, IA; Iowa State Univ. (1980). 169p. University Microfilms Order No. 81-06,060.

Thesis (Ph. D.).

Doppler-free intracavity two-photon absorption in gas phase naphthalene was demonstrated for the first time. A cw tunable dye laser system was modified to incorporate an intracavity gas cell. The observed linewidths of the Doppler-free two-photon rovibronic features of the naphthalene $S_1$ reverse arrow $S_0$ excitation spectrum are on the order of 300 MHz. The combined effects of laser width, frequency scanning rate and high density of states prevented us from resolving individual rovibronic lines. A giant-pulse ruby laser and a cw tunable dye laser were combined to form a unique inverse Raman Spectrometer for the determination of absolute Raman cross sections. The absolute Raman cross section for the nitrobenzene line at 1345 $cm^{-1}$ was determined to be (2.37 +- 0.51) x $10^{-29}$ $cm^2$ $s1^{-1}$. D reverse arrow X resonance enhanced three-photon excitation spectra of iodine were observed by a cw intracavity absorption technique. Vibrational quantum numbers of the D reverse arrow X transitions are given for every major spectral feature. The corresponding one-photon enhancement from the B state is evident from the one-photon vibrational assignment. The spectroscopic constants for the D state are $\upsilon_{00}$ = 40998 $cm^{-1}$, $\omega_0'$ = 113 $cm^{-1}$ and $\omega_0'X_0'$ = 0.045 $cm^{-1}$.

**33601 Equilibrium between type I and type II $M^{3+}$-$F_1^-$ complexes in alkaline earth fluorides.** Crawford, J.H. Jr.; Matthews, G.E. (Univ. of North Carolina, Chapel Hill). Contract E40-1-3766. *Journal de Physique (Orsay, France) ;* **37**: No. 12, 297-301(Dec 1976).

The model for the structure of impurity-interstitial fluoride dipoles in $CaF_2$ + $SrF_2$ doped with trivalent rare earth impurity has been investigated using ionic thermocurrent (ITC) techniques. The temperature dependence of the relative concentrations of type II (next-nearest neighbor $M^{3+}$-$F_1^-$ dipoles which have trigonal symmetry) to type I (nearest-neighbor $M^{3+}$-$F_1^-$ dipoles with tetragonal symmetry) was examined over the region spanned by the upper ITC peak thought to be associated with type II dipole relaxation. For $SrF_2$:$Gd^{3+}$ excellent agreement with expected behavior was observed and the enthalpy difference between the two dipole species was found to be 0.046 eV. The ratio of type II to type I was also found to increase with decreasing size of $M^{3+}$ in agreement with previous reports. The behavior of dipoles in CaF:$Gd^{3+}$ and $CaF_2$:$Tm^{3+}$ was not consistent with simple equilibrium suggesting that either type II dipoles in $CaF_2$ relax by some path which does not involve type I sites or the upper temperature relaxation peak is caused by an as yet unidentified dipolar structure. The effect of ion size in $CaF_2$:$M^{3+}$ on the relative amplitudes of type I and type II peaks showed no systematic variation.

**33602 Thermodynamics of electrolytes. IV. Activity and osmotic coefficients for mixed electrolytes.** Pitzer, K.S.; Kim, J.J. (Univ. of California, Berkeley). *Journal of the American Chemical Society ;* **96**: No. 18, 5701-5707(4 Sep 1974).

An equation has been developed with the guidance of recent statistical theories of electrolytes which is designed for convenient and accurate representation and prediction of the thermodynamic properties of aqueous electrolytes including mixtures with any number of components. The three previous papers have given the theoretical background and the evaluation of parameters for pure electrolytes of various charge types. The equation is here applied to a wide variety of mixed aqueous electrolytes at room temperature and at ionic strengths up to 6 M in many cases and occasionally even higher. The first objective is the prediction of properties of mixed electrolytes using only the parameters for pure electrolytes; on this basis standard deviations in ln $\gamma$ or phi for 69 sets of mixtures are less than 0.01 in 36 cases and above 0.05 in only seven cases all involving $Cs^+$ or $OH^-$. A second objective is the determination of parameters giving the differences in short-range interaction of ions of the same sign where these differ significantly from zero. As expected, these difference terms, while always small, are relatively most important for singly charged ions (and especially for $OH^-$ and $Cs^+$) and less important for ions of higher charge. The equations, including difference terms where known from binary mixtures with a common ion, were finally tested on 17 sets of mixtures involvingfour or more ions without any further adjustment of parameters. The standard deviation is less than 0.01 in all cases and is 0.003 or less in 11 cases. Thus these equations appear to yield accurate predictions of properties of mixed aqueous electrolytes. 5 tables.

**33603 Spectrum and energy levels of quadrupole-ionized vanadium (V v).** Van Deurzen, C.H.H.; Conway, J.G.; Davis, S.P. (Univ. of California, Berkeley). *Journal of the Optical Society of America ;* **64**: No. 4, 498-502(Apr 1974).

The spectrum of V v has been observed by using a vacuum sliding spark at 1000-A peak current. Fifty-nine lines in the region 480-8500 A have been observed and interpreted as transitions among 29 levels, 19 of which are new. The ionization energy is determined as 526 524 +- 5 $cm^{-1}$. An isoelectronic comparison confirms the inversion of the $3p^64f^2F/sub\ 5/2,7/2/^0$ levels as being caused by their interaction with those of the $^2F^0$ term in the $3p^53d^2$ configuration.

**33604 Kinetics of dissociative vaporization reactions.** Meschi, D.J.; Searcy, A.W. (Univ. of California, Berkeley). *High Temperature Science ;* **6**: 221-236(1974).

Chemical kinetics of sequential reactions and transition state theory are applied to the terrace-ledge-kink model for the vaporization of solids and more specifically to compounds which vaporize according to the reaction 2AB(s) = 2A(g) + $B_2$(g). The variation of vaporization rate with temperature depends on the difference in enthalpy between the activated complex of the rate-determining step and the enthalpy of the bulk solid and can thus be used as a guide in ascertaining which of the sequential steps is rate determining. This is illustrated with respect to the above vaporization reaction by comparing the case in which kink-pair nucleation is rate determining with that in which desorption is rate determining. For a temperature range in which two steps in the sequence both influence the rate, the plot of the logarithm of an apparent equilibrium constant K* versus the inverse of the temperature will usually show a curvature. Experimental evidence of this effect in the vaporizaton of ice and of sodium chloride are cited. Vaporization studies of II-VI compounds are discussed and the data are found to be consistent with a model in which desorption or dissociation from catalytic surface sites is rate limiting. 2 figures.

## 4003 Organic Chemistry

*REFER ALSO TO CITATION(S) 32808, 32860, 33553, 33620, 33960*

**33605 (BNL—29817) Oxidation of formic acid and methanol on single crystal platinum electrodes.** Adzic, R.R.; Tripkovic, A.V.; O'Grady, W.E. (Brookhaven National Lab., Upton, NY (USA); Belgrade Univ. (Yugoslavia)). 1981. Contract AC02-76CH00016. 13p. (CONF-8105105—3). NTIS, PC A02/MF A01. Order Number DE81028330.

From Symposium on electrocatalyis; Minneapolis, MN, USA (10 May 1981).

The oxidation of formic acid and methanol involves strong adsorption prior to the charge transfer process and the intermediate formed in these reactions are even more strongly adsorbed. It has been found that these processes are highly dependent on the surface orientation of the single crystal electrodes. The highest activity has been found with (111) orientation and the lowest with (100). The highest activity of (111) orientation has been explained with the low hydrogen adsorption on this plane, and the low adsorption of strong bond intermediates which require two or three sites for their adsorption. This more than compensates for the low reactivity of the (111) plane toward formic acid and methanol themselves.

**33606 (CONF-810914—4) Model compound study of the mechanism of $sp^2$-$sp^3$ carbon-carbon cleavage during the reduction of coals.** Collins, C.J.; Hombach, H.P.; Maxwell, B.E.; Benjamin, B.M. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE81029685.

From International conference on coal science; Dusseldorf, F.R. Germany (7 Sep 1981).

The $sp^3$-$sp^2$ bonds in bibenzyl can cleave in the presence of Na(K) at $0^0$ in glyme and triglyme by simple fragmentation of the substrate radical anion. In the case of diphenylmethane itself, the $sp^2$-$sp^3$ bond is too strong to be cleaved by simple fragmentation. In this event cleavage occurs through a bimolecular reaction between a diphenylmethane molecule and a diphenylmethane radical anion. When the reaction of diphenylmethane with NaK is carried out in the presence of benzene, a bimolecular reaction between benzene radical anion and diphenylmethane occurs yielding, among other products, toluene, biphenyl, and hydrogenated biphenyls. α-Benzylnaphthalene, under the same reaction conditions, appears to cleave both by fragmentation of the benzylnaphthalene radical anion, eq. (9), as well as by ipso-nucleophilic attack of the radical anion on α-benzylnaphthalene.

**33607 Effect of network structure on moisture absorption of epoxy resins.** Diamant, Y.; Marom, G.; Broutman, L.J. (Illinois Inst. of Tech., Chicago). *Journal of Applied Polymer Science ;* **26**: No. 9, 3015-3025(Sep 1981).

An investigation of the effect of modifying the network structure on moisture absorption of epoxies was performed. The network was modified by crosslinking the epoxides wth various mono/diamine proportions, resulting in decreasing density and increasing free volume. It was discovered, however, that concomitant effects, i.e., the formation of a two-phase structure, and changes in resin polarity and in resin-water affiniy predominated. Thus, compositions with higher chain molecular weights between crosslink points yet exhibited lower diffusion coeficients. Also, when drastic swelling conditions (such as a water-boil treatment) were employed, moisture absorption was facilitated by penetration via newly formed microcracks.

**33608 Thermochemical studies of carbonyl reactions. 2. Steric effects in acetal and ketal hydrolysis.** Wiberg, K.A.; Squires, R.R. (Yale Univ., New Haven, CT). *Journal of the American Chemical Society ;* **103**: No. 15, 4473-4478(29 Jul 1981).

A calorimetric determination of the enthalpies of hydrolysis of a series of alkyl-substituted dimethyl acetals is reported. These data are critially compared with the enthalpies of hydrolysis from an analogous set of aliphatic dimethyl ketals derived from 2-alkanones. The acetals exhibit a significantly attenuated range in their enthalpies of hydrolysis relative to that for ketal hydrolysis. The free energies of acetal formation in solution were modeled by measurements of the corresponding free energies of themiacetal formation from the aldehydes in neutral methanol. The observed free-energy differences are satisfactorily correlated with the Taft E/sub s/ steric substituent constant scale, but the corresponding acetal enthalpy data vary in a complex manner. The role of entropy in determining kinetic and equilibrium steric effects in a variety of other systems is discussed. Preliminary molecular mechanics calculations on these systems indicate the importance of bond angle bending in evaluating the torsional potential at a carbonyl group. Many of the compounds were found to possess several conformations having comparable energies.

**33609 Stereoelectronic properties of photosynthetic and related systems. 10. Quantum mechanical characterization of the excited states of ethyl chlorophyllide α enol.** Petke, J.D.; Shipman, L.L.; Maggiora, G.M.; Christoffersen, R.E. (Univ. of Kansas, Lawrence). *Journal of the American Chemical Society ;* **103**: No. 15, 4622-4623(29 Jul 1981).

This paper deals with the interpretation of the electronic absorption spectra of chlorophyll a enols. Ab initio configuration interaction calculations were performed on ethyl chlorophyllide a enol (EtChl a enol). The electronic states of EtChl a enol are much more polar than those of EtChla. Unlike EtCla, there is no low-lying triplet state in EtCl a enol within 2000 $cm^{-1}$ of $S_1$, suggesting that intersystem crossing may be more difficult in EtCl a enol than in EtChl a. (DLC)

## 4004 Electrochemistry

*REFER ALSO TO CITATION(S) 33602, 33605*

**33610 Determination of surface inhomogeneities qfing a scanning probe impedance technique.** Isaacs, H.S.; Kendig, M.W. (Brookhaven National Lab., Upton, NY). Contract EY-76-C-02-0016. *Corrosion ;* **36**: No. 6, 269-274(1980).

A scanning ac probe technique has been developed to measure the impedance variations of electrode surfaces in electrolytes resulting from heterogeneities. The technique can be applied to all conducting surfaces in conducting liquids. Measurements have been conducted on abraded specimens, partially etched Alloy 600, mixed alloy surfaces. Type 304 stainless steel welds, and corroding polymer coated zinc plated surfaces. With all specimens, marked variations in impedance were observed.

**33611 Improvements on computer simulation of electrochemical phenomena involving hydrodynamics: the rotating disk and the dropping mercury electrode.** Fedlberg, S.W. (Brookhaven National Lab., Upton, NY). Contract AC02-76CH0016. *Journal of Electroanalytical Chemistry ;* **109**: 69-82(1980).

The previously described method for computer simulation of the rotating disk electrode (RDE) and the dropping mercury electrode (DME) involved a rather cumbersome algorithm to describe the hydrodynamic aspect of the transport of material toward the electrode surface. Simplified algorithms are presented which are faster, more accurate and intuitively more appealing in their correspondence to the differential equations describing the systems. Furthermore, they retain the simplicity and conveniences of the explicit finite-difference equations, thus facilitating introduction of both heterogeneous and homogeneous kinetic modifications.

## 4005 Photochemistry

*REFER ALSO TO CITATION(S) 33852, 33854*

**33612** (LBL—12000, pp 457-467) **Advanced isotope separation technology.** Moore, B. Jun 1981. NTIS, PC A24/MF A01. Order Number DE81027828.

In Materials and Molecular Research Division annual report 1980.

Individual reports are given on: laser photolysis of tetralin; quenching, electronic energy transfer and rotational relaxation of $S_1$ formaldehyde; photofragmentation translational spectroscopy of $Br_2$; photodissociation of bromine dimers; vibrational predissocia-

tion spectra of molecular dimers; and vibrational effects of reactive scattering of $CF_3I$ + Br.

**33613 Intramolecular energy transfer in polymers containing benzoyl and naphthalene moieties.** Das, P.K.; Encinas, M.V.; Scaiano, J.C. (Univ. of Notre Dame, IN). *Journal of Photochemistry ;* **12**: 357-361(1980).

This communication reports preliminary results on the photochemistry of copolymers of methylmethacrylate-phenyl vinyl ketone-2-vinylnaphthalene. Solutions of these copolymers were examined using nanosecond laser flash photolysis techniques. The direct measurement of the kinetics of intramolecular processes of this nature was carried out.

**33614 Laser-induced photoelectrochemistry: scavenging of photoemitted electrons in aqueous and non-aqueous solutions by electroactive organic species.** Richardson, J.H. (Lawrence Livermore Lab., CA); Kovalenko, L.J.; Deutscher, S.B.; Harrar, J.E.; Perone, S.P. Contract W-7405-ENG-48. *Journal of Electroanalytical Chemistry ;* **106**: 263-275(1980).

Photoemission current at a mercury electrode has been characterized electrochemically for aqueous solutions of methyl viologen, the disodium salt of anthraquinone-1,5-disulfonic acid, hydroquinone, p-benzoquinone, and chlorophyllin, and in DMF solutions of $N_2O$ and anthraquinone. The scavenging species could be determined by comparing photoemission current-voltage curves with polarographic and cyclic voltammetric data. 11 figures.

**33615 Lifetimes of electronically excited $UF_6$ in the presence of inorganic quenchers.** Wampler, F.B.; Oldenborg, R.C.; Rice, W.W. (Los Alamos Scientific Lab., NM). *Journal of Photochemistry ;* **9**: 473-479(1978).

$UF_6$ was excited at 3935 A by a nitrogen-laser-pumped dye laser and the lifetimes of $^*UF_6$ were determined in the presence of selected inorganic gases. The following low pressure quenching rate constants (units of $10^{11}$ l $mol^{-1}s^{-1}$) were determined: oxygen, 1.0; helium, 0.0095; argon, 0.0097; hydrogen, 0.013; CO, 0.024; fluorine, 0.016; nitrogen, 0.018; $SF_6$, 0.015. All the gases except oxygen at high pressures give $^*UF_6$ lifetimes much longer than those calculated from the low pressure rate constants. The lifetime behavior at high pressures is consistent with a mathematical formulation which predicts that the zero pressure value derived from a high pressure asymptotic extrapolation is independent of the chemical identity of the quenching gas. 4 figures, 2 tables.

## 4006 Radiation Chemistry

**33616 (NASA-TM—81670) New ion exchange membranes.** Philipp, W.H.; May, C.E.; Hsu, L.C. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1980. 14p. NTIS PC A2/MF A01.

A technique for the preparation of ion exchange films composed of radiation crosslinked polyacrylic acid and crosslinked polyacrylate salts is presented. Results suggest that radiolytic crosslinking occurs at the alpha carbon on polyacrylic acid via hydrogen abstraction by hydrogen atoms produced by the radiolytic decomposition of water. Conditions of reaction media and radiation dose are discussed for optimum crosslinking. Practical use of crosslinked polyacrylate ion exchange films for the removal of metal cations from dilute solution was demonstrated on a laboratory scale. The wet strength of membranes comprising various polyacrylate salts is correlated with water content of the swelled membrane.

**33617 Extension of a spur overlap model for the radiolysis of water to include high linear energy transfer regions.** Short, D.R.; Trumbore, C.N.; Olson, J.H. (Univ. of Delaware, Newark). *Journal of Physical Chemistry ;* **85**: No. 16, 2328-2335(6 Aug 1981).

Results are presented from computer calculations based upon an improved diffusion-kinetic model of the spur which includes a novel initial distribution for the hydrated electron, an approximate mathematical treatment of the spherically symmetrical overlap of spurs, and a high linear energy transfer (LET) component. The results of such calculations for various conditions of pulse dose and concentrations of scavengers of individual primary chemical species in the spur are compared with experimental data obtained from water and aqueous solutions irradiated with 10-15 MeV electron pulses. Very good agreement between calculated and experimental hydrated electron decay kinetics in pure water was observed earlier at high pulse dose. However, the calculated and experimental curves are observed to deviate for times greater than 10 ns when low pulses doses and low scavenger concentrations are considered. This deviation in experimental and calculated hydrated electron decay cannot be explained by assuming the presence of a hydrated electron scavenging impurity or by employing a random distribution of nearest-neighbor interspur distances to refine the overlap approximation. However, calculations which model a constant percentage of the total energy deposition in high spur density (high-LET) regions are shown to produce good agreement with pure-water data over the entire time range studied for all pulse-dose values considered. These results provide support for theories proposing the formation of a significant number of high-LET regions in water irradiated with electrons generally characterized as being of low LET.

**33618 Transient phenomena in the pulse radiolysis of retinyl polyenes. I. Radical anions.** Raghavan, N.V.; Das, P.K.; Bobrowski, K. (Univ. of Notre Dame, IN). *Journal of the American Chemical Society ;* No. 15, 4569-4573(29 Jul 1981).

The spectra and kinetics of formation and decay of radical anions of a number of retinyl polenes have been studied in methanol and 2-propanol at room temperature, using pulse radiolysis and kinetic spectrophotometry. The bimolecular rate constants for the attachment of solvated electrons, $e^-$/sub MeOH/, to the retinyl polyenes are in the diffusion-controlled limit ($8.6 \times 10^9$-$1.6 \times 10^{10}$ $M^{-1}$ $s^{-1}$). The radical anions of retinol and retinol acetate have their spectral maxima at 370 to 390 nm, and undergo decay very slowly with second-order kinetics. On the other hand, the radical anions of retinal, retinal n-butylamine Schiff base, and retinoic acid/ester have spectral maxima at 430 to 510 nm, and decay by first-order kinetics in methanol with rate constants in the range $1 \times 10^4$ - $1 \times 10^6$ $s^{-1}$. The decay rates of radical anions of retinal and retinoic acid/ester become considerably longer on going from methanol to less acidic alcohol, 2-propanol, suggesting that protonation by sovent is the major mode of their decay in protic media. In the case of retinal Schiff base, an additional slow process with bimolecular rate constant $9.0 \times 10^7$ $M^{-1}$ $s^{-1}$ in methanol is observed for the formation of radical anion and is ascribed to the electron-transfer reaction from the methanol radical, $CH_2OH$. 6 figures.

## 4007 Radiochemistry And Nuclear Chemistry

*REFER ALSO TO CITATION(S) 33615, 33799*

**33619 (LA-UR—81-2530) Measurement of gas density and temperature distributions in strongly rotating $UF_6$ using laser-induced fluorescence.** Gentry, R.A.; Caldwell, S.E.; White, R.W. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 58p. (CONF-810845—3). NTIS, PC A04/MF A01. Order Number DE81030136.

From 4. workshop on gases in strong rotation; Oxford, UK (24 Aug 1981).

A new technique for using Laser Induced Fluorescence (LIF) signals to measure the distribution of gas density and temperature in strongly rotating $UF_6$ gas is presented. An external pulsed laser is used to excite the rotating $UF_6$ gas, producing an exponentially decaying fluorescence signal. A multi-channel fiber optics system simultaneously collects the fluorescence signals emanating from a number of points in the gas. The signals from each optical channel are digitized and processed to determine the fluorescence signal intensity and decay lifetime at each of the points of observation by means of a least squares fitting process. Gas densities and temperatures are then determined from the intensity and lifetime data. A recently constructed LIF probe system is described and an analysis of the unfolding techniques necessary to process the signal data is presented. Preliminary data, obtained in tests of the probe system in a laboratory rotor, are presented.

33620 (LBL—12000, pp 381-410) **Low-energy nuclear sciences.** Edelstein, N.M.; Andersen, R.A.; Bartlett, N.; Conway, J.G.; Raymond, K.N.; Seaborg, G.T.; Strietwieser, A. Jr.; Templeton, D.H.; Zalkin, A. Jun 1981. NTIS, PC A24/MF A01. Order Number DE81027828.

In Materials and Molecular Research Division annual report 1980.

Research in the area of heavy element chemistry was conducted. Reports are included on: specific sequestering agents for the actinides, synthetic and structural studies of actinides and other compounds; and physical and spectroscopic studies. (DMC)

33621 **(LBL—12441) Actinides-1981.** (Lawrence Berkeley Lab., CA (USA)). Sep 1981. Contract W-7405-ENG-48. 322p. (CONF-810948—(Absts)). NTIS, PC A14/MF A01. Order Number DE81030350.

From Actinides-1981 conference; Pacific Grove, CA, USA (10 Sep 1981).

Abstracts of 134 papers which were presented at the Actinides-1981 conference are presented. Approximately half of these papers deal with electronic structure of the actinides. Others deal with solid state chemistry, nuclear physic, thermodynamic properties, solution chemistry, and applied chemistry.

33622 **(RFP—3180) Chemistry research and development. Annual progress report, November 1, 1979-October 31, 1980.** Miner, F.J. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 4 Aug 1981. Contract AC04-76DP03533. 71p. NTIS, PC A04/MF A01. Order Number DE81030182.

Chemistry R & D is involved in a number of programs. These programs include process support to Rocky Flats production operations, development of pyrochemical processes for plutonium recovery and purification in addition to integration of these processes into production, actinide separation research, determination of thermodynamic properties of plutonium and plutonium compounds, preparation of special alloys for use in radiochemical tracer programs, development of processes for decontaminating plutonium and plutonium compounds, preparation of special alloys for use in radiochemical tracer programs, development of processes for decontaminating plutonium-contaminated soils, characterization of the surfaces of various metals, and investigating the mechanisms and kinetics of the plutonium-hydrogen-oxygen systems. Some specific highlights for the report period include the following: (1) as part of the ongoing soil decontamination program at Rocky Flats, a site survey was completed in which data on contaminated soils in the United States were assembled and a set of soil contamination criteria was proposed to govern the disposition of effluent soil fractions from a soil decontamination process; (2) a series of disks were prepared for a Radiochemical Diagnostic Tracer Program from plutonium-242 and from an alloy of cerium and americium-241; (3) a material balance around past and current americium recovery processes was completed; (4) the technical feasibility of the pyroredox process was established for purification of plutonium in a tilt-pour furnace; and (5) in the continuing investigation of the plutonium-hydrogen system, it was shown that the kinetics of the hydriding of plutonium in a powder form is proportional to the hydrogen pressure below a pressure of 1000 Pa and is independent of the hydrogen pressure above 1000 Pa.

33623 **Tricatecholamide analogs of enterobactin as gallium- and indium-binding radiopharmaceuticals.** Moerlein, S.M. (Washington Univ., St. Louis, MO); Welch, M.J.; Raymond, K.N.; Weitl, F.L. Contract AS02-77EV04318. *Journal of Nuclear Medicine ;* **22**: No. 8, 710-719(Aug 1981).

Isopropyl N-subtituted tricatecholamide analogs of enterobactin have been found to form gallium and indium complexes with very high stability constants and to exhibit in vivo characteristics significantly different from gallium- or indium-transferrin and EDTA. The 3,4-DiP-LICAMS and TiP-MECAMS complexes were found to clear primarily through the kidney, whereas the less polar 3,4 DiP-LICAM complex was eliminated through the liver. The rationale for developing new metalbinding analogs with larger organic groups attached to the amide nitrogens is discussed.

33624 **Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium.** Hulet, E.K. (Lawrence Livermore Lab., CA). Contract W-7405-ENG-48. *ACS (American Chemical Society) Symposium Series ;* No. 131, 239-263(1980).

The chemical properties of the heavy actinides systematically deviate from those of their lanthanide counterparts. The differences between the later elements of the 4f and 5f series can be generally interpreted on the basis of subtle changes in electronic structure. The most important change is a lowering of the 5f energy levels with respect to the Fermi level and a wider separation between the 5f ground states and the first excited states in the 6d or 7p levels. It was concluded that these shifts toward greater stabilization of 5f orbitals with increasing atomic number are mainly supported by the appearance of the divalent oxidation state well before the end of the actinide series and the predominance of the divalent state in the next to last element in the series. The chemistry of fermium, mendelevium, nobelium, and lawrencium was discussed. 8 figures 4 tables. (DP)

33625 **Current status of the transuranium processing plant.** King, L.J. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Proceedings of the Conference on Remote Systems Technology ;* **27**: 96-102(1979).

The primary mission of the Transuranium Processing Plant (TRU) continues to be the production of transuranium elements for research. Improvements in chemical processes, process equipment, operating techniques, and feed materials have made it unnecessary to operate at full capacity to satisfy the needs of the heavy-element research community. About 25% of the total effort at TRU is now being devoted to other programs. 6 figures.

## 4008 Combustion, Pyrolysis, And High-temperature Chemistry

*REFER ALSO TO CITATION(S) 32944, 33083*

33626 **(LBL—13178) Molecular-beam system for the study of transient combustion processes.** Hurlbut, F.C.; Oppenheim, A.K.; Coico, P.; Peterson, R. (Lawrence Berkeley Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 39p. NTIS, PC A03/MF A01. Order Number DE81030663.

Construction of a direct sampling molecular beam apparatus for the measurement of concentration histories of short-lived species, in particular active radicals serving as chain carriers in the course of ignition in a hydrocarbon-air mixture, is described, including some prominent features of its design analysis. Whereas the system is not yet finished in all peripheral details, central elements have reached a sufficient degree of completion and level of function to warrant its documentation in the form of a preliminary report, incorporating the results of preliminary performance evaluation. The latter includes the measurement of the shutter function, showing the modulation of the beam monitored by a chopper to check its quality, and a time of arrival record from which it was established that the beam is fully supersonic at a Mach number of 2.34.

33627 **Multicomponent fuel droplet vaporization at large Reynolds numbers.** Lerner, S.L. Princeton, NJ; Princeton Univ. (1981). 240p. University Microfilms Order No. 81-11,281.

Thesis (Ph. D.).

Both single-component n-hexane droplets and bicomponent droplets of n-heptane and n-dodecane, vaporizing at Reynolds numbers and vaporization rate coefficients up to 300 and 1 x $10^{-2}$ $cm^2/s$ were investigated. A semi-empirical model, that includes unsteady droplet heating is shown to accurately predict the temporal variation of droplet diameter and trajectory for single-component droplets. The drag coefficient is given by the standard drag curve for solid spheres, with the Reynolds number determined by the 1/3 rule. Thus, the Reynolds number that governs droplet vaporization and drag is an average Reynolds number based upon reference properties. Since this reference Reynolds number can be as much as 6 times larger than the Reynolds number based upon free stream properties, the importance of the high Reynolds number problem is

magnified over that previously predicted. The effect of droplet asymmetry on the droplet's trajectory, compsition, and vaporization rate is shown to be negligible. For multicomponent droplets the assumption that no internal mixing is occurring within the droplet and that the only internal mechanism of mass transfer is diffusion, underpredicts the compositional change of the droplet. However, the assumption of a spatially uniform composition within the droplet overpredicts the actual compositional change experienced by the droplet, supporting some intermediate model.

# 42 ENGINEERING

## 4202 Facilities And Equipment

*REFER ALSO TO CITATION(S) 32907, 32908, 32943, 32975, 33056, 33501, 33526, 33566, 33658, 33671, 33679, 33680, 33681, 33682, 33683, 33684, 34086, 34087, 34089, 34136*

33628 **(BDX—613-2623) Drill geometries for miniature holes.** Gillespie, L.K. (Bendix Corp., Kansas City, MO (USA)). Aug 1981. Contract AC04-76DP00613. 55p. NTIS, PC A04/MF A01. Order Number DE81030189.

Many users are unaware of the wide variety of drills available in sizes 0.040 inch (1 mm) and smaller. At least 15 different standard designs are in production in four tool materials. When helix angle and direction are taken into account, users have 29 different geometries to select from and over 2000 different combinations of size and geometry. A survey of commercially available miniature drills is presented.

33629 **(BDX—613-2644) Tooling for electrochemical deburring. Topical report.** Moore, W.M. (Bendix Corp., Kansas City, MO (USA)). Aug 1981. Contract AC04-76DP00613. 59p. NTIS, PC A04/MF A01. Order Number DE81030190.

Observations on the design and construction of electrochemical deburring tools are reported. Specific areas discussed include tooling limitations, process limitations, characteristics of the electrode, insulation of critical areas, and basic concepts for preventing tooling problems. The observations are based on an analysis of over 40 applications on precision miniature mechanism components.

33630 **(BNL—30012) Cryopumping of hydrogen and helium.** Halama, H.J.; Hseuh, H.C.; Chou, T.S. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 8p. (CONF-810835—29). NTIS, PC A02/MF A01. Order Number DE81030553.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

Results obtained in numerous tests on small ($\sim$ 1000 l/S) and large ($\sim 10^5$ l/S) cryopumps cooled to 4.2°K by LHe or between 10 to 20°K by closed-cycle helium refrigerator are summarized. Then, measurements of the compound cryopump, designed to work on Tokamaks to handle the exhaust gases from the Torus are presented.

33631 **(BNL—51369) Hydride chemical compressor. Phase I, final report.** Lynch, F.E.; Nye, R.A.; Turillon, P.P. (Brookhaven National Lab., Upton, NY (USA); Hydrogen Consultants, Inc., Denver, CO (USA); Denver Research Inst., CO (USA); ERGENICS, Wyckoff, NJ (USA)). Jan 1981. Contract AC02-76CH00016. 43p. NTIS, PC A03/MF A01. Order Number DE81030199.

A proof-of-concept, bench-size hydride chemical compressor has been successfully designed, constructed, and tested. It consists of two electrically heated tube bundles each containing 15 kg of hydriding alloys. The tube bundles are alternately heated and cooled in order to provide continuous output of high pressure hydrogen. Electrical resistance heating was selected for ease of demonstration and testing. In continuous operation, this hydride compressor delivered 20.3 liters/min (43 SCFH) of hydrogen at a pressure of 42.2 atmospheres (650 psia). In one experiment, a peak pressure of 75 atm (1100 psia) was obtained with the power supply available. The efficiency of operation was lower than anticipated (4.5% instead of 12%). The reduced efficiency of the bench-scale unit was caused by mechanical design details (such as the excessive amount of copper due to the electrical heating system) as well as problems with the hydriding alloy (reduced capacity at elevated temperature and low plateau pressure at room temperature). After 700 cycles of operation, an increase in heating time and corresponding reduction in efficiency were observed. A sample of the hydriding alloy was removed from the unit and analyzed. Evaluation of this sample revealed a decrease in plateau pressure for a given temperature compared to a sample of the same alloy before compressor cycling. The increase in alloy stability resulted in longer cycling time. A step-by-step analysis of the parameters affecting overall efficiency showed that the major factors were the thermal mass of the system, the fraction of hydride decomposed at high temperature and the losses by radiation and thermal convection. The results of these tests will be used in the design of improved hydride chemical compressor for industrial applications.

33632 **(CONF-810742—2) Experimental and theoretical study of a tall building subjected to wind loading.** Mills, R.S. (URS/John A. Blume and Associates, Engineers, San Francisco, CA (USA)). 1981. Contract AC08-81NV10145. 9p. NTIS, PC A02/MF A01. Order Number DE81029478.

From 4. U.S. national conference on wind engineering research; Seattle, WA, USA (26 Jul 1981).

Full-scale experimental observations of the wind-induced response of a building of moderate height have shown that dynamic considerations may be negligible for stress analysis of alongwind response. For analysis of acrosswind response and human perception, however, dynamic relationships must be accurately modeled. The contribution of torsional response is also significant and may be produced by aerodynamic properties even when the building system appears to be structurally symmetric. Predictions of alongwind response of the building obtained from a recently developed analytical procedure show reasonable agreement with observed response.

33633 **(CONF-810835—12) Cryogenic pressure testing of demountable seals for large-coil program applications.** Schwenterly, S.W.; Fitzpatrick, C.M. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01. Order Number DE81026548.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

A total of four sample K seals was used in the tests. Two were 57 mm in outside diameter and coated with lead, and two were 48 mm in outside diameter and coated with teflon. (MOW)

33634 **4 K to 20 K rotational-cooling magnetic refrigerator capable of 1 mW to 'GT' 1 W operation.** Barclay, J.A. (Los Alamos Scientific Lab., NM (USA)). *Cryogenics ;* **20**: No. 8, 467-471(Aug 1980).

The low-temperature, magnetic entropy of certain single-crystal paramagnetic materials, eg $DyPO_4$ changes dramatically as the crystal rotates in a magnetic field. A new magnetic refrigerator design based on the anisotropic nature of such materials is presented. The key advantages of the rotational-cooling concept are: a single, rotary motion is required; magnetic field shaping is not a problem because the entire working material is in a constant field; and the size of the refrigerator is smaller than other comparable magnetic refrigerators because the working material is entirely inside the magnet at all times. The main disadvantage of the rotational-cooling concept is that small-dimension single crystals are required.

33635 **(HEDL-SA—2201-FP) Heat transfer in a fuel pin shipping container.** Ingham, J.G. (Hanford Engineering Development Lab., Richland, WA (USA)). 11 Nov 1980. Contract AC14-76FF02170. 28p. (CONF-810804—15). NTIS, PC A03/MF A01. Order Number DE81029758.

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

Maximum cladding temperatures occur when the IDENT 1578 fuel pin shipping container is installed in the T-3 Cask. The maximum allowable cladding temperature of 800°F is reached when the rate of energy deposited in the 19-pin basket reaches 400 watts. Since 45% of the energy which is generated in the fuel es-

capes the 19-pin basket without being deposited, mostly gamma energy, the maximum allowable rate of heat generation is 400/.55 = 727 watts. Similarly, the maximum allowable cladding temperature of 800°F is reached when the rate of energy deposited in the 40-pin basket reaches 465 watts. Since 33% of the energy which is generated in the fuel escapes the 40-pin basket without being deposited, mostly gamma energy, the maximum allowable rate of heat generation is 465/.66 = 704 watts. The IDENT 1578 fuel pin shipping container therefore meets its thermal design criteria. IDENT 1578 can handle fuel pins with a decay heat load of 600 watts while maintaining the maximum fuel pin cladding temperature below 800°F. The emissivities which were determined from the test results for the basket tubes and container are relatively low and correspond to new, shiny conditions. As the IDENT 1578 container is exposed to high temperatures for extended periods of time during the transportation of fuel pins, the emissivities will probably increase. This will result in reduced temperatures.

33636 **(LA—8894-MS) Development of two-phase flow and material-transport models for large-diameter drilling systems: program overview and preliminary results.** Gregory, W.S. (comp.). (Los Alamos Scientific Lab., NM (USA)). Jul 1981. Contract W-7405-ENG-36. 43p. NTIS, PC A03/MF A01. Order Number DE81030502.

This report describes the approach and preliminary results in investigating the behavior of fluid and material transport beneath a 20-ft-diam rotating drill bit assembly. Both analytical and laboratory models of this two-phase transport problem are being developed. Preliminary results obtained using a quasi-three-dimensional numerical model of the drilling system are described. In addition, analytical studies are in progress where a single cutter is isolated and the surrounding flow field is studied. A fully three-dimensional numerical model is described, along with examples of preliminary results. A brief similarity analysis and description of laboratory models under construction are also presented. Experiments using a single cutter to obtain material size distributions are discussed.

33637 **(LBL—12783) Gas cooled electrical leads for use on forced cooled superconducting magnets.** Smits, R.G.; Andrews, P.L.; Burns, W.A.; Day, C.T.; Gary, J.W.; Gibson, G.H.; Green, M.A.; Pripstein, M.; Ross, R.R.; Taylor, J.D. (Lawrence Berkeley Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 9p. (CONF-810835—18). NTIS, PC A02/MF A01. Order Number DE81029855.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

This paper describes the fabrication and testing of a pair of single tube leads which carry one fifth of the time projection chamber magnet current. Since one of the TPC magnet leads is horizontal within the vacuum chamber, the test leads were tested in a near horizontal position. From the tests, one can predict the performance of the composite TPC magnet lead or the performance of other leads built with multiple tube bundles.

33638 **(PNL-SA—9635) Proposed draft standard ANS 11.18: recommendations to facilitate decontamination and decommissioning.** Jenkins, C.E.; LaGuardia, T.S.; Jones, J.W. (Pacific Northwest Lab., Richland, WA (USA); Nuclear Energy Services, Inc., Danbury, CT (USA); Quadrex, Richland, WA (USA)). 1981. Contract AC06-76RL01830. 16p. (CONF-810606—97). NTIS, PC A02/MF A01. Order Number DE81030082.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

The purpose of ANS Standard 11.18 is to recommend design guides to facilitate decontamination and eventual decommissioning of a remotely operated radioactive facility. This design guide contains generic recommendations to assist in the planning, selection and arrangement of equipment and materials, and the protection of surfaces to enhance system decontamination and disassembly.

33639 **(SAND—81-0208C) Development of the ARIES parachute system.** Pepper, W.B.; Collins, F.M. (Sandia National Labs., Albuquerque, NM (USA); National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). 1981. Contract AC04-76DP00789. 11p. (CONF-811002—1). NTIS, PC A02/MF A01. Order Number DE81012161.

From 7. AIAA aerodynamic decelerator and balloon technology conference; San Diego, CA, USA (21 Oct 1981).

The design and testing of a two-stage parachute system to recover a space telescope weighing up to 2000 pounds is described. The system consists of a 15-ft dia ribbon parachute reefed to 50% for 10 seconds and a 73-ft dia paraform or cross second stage reefed to 10% for 10 seconds. The results of eight drop tests and one operational rocket launched flight and recovery are presented. A successful operational recovery of a 1600-lb NASA space telescope was conducted at White Sands Missile Range, NM, in September 1980. The payload was launched by a second stage Minuteman rocket to an altitude of about 300 miles above sea level. An operational recovery of a 200-lb NASA space telescope is scheduled for April 4, 1981, at WSMR.

33640 **(UCRL—85564) Evaluation of shielded metal arc and flux cored metal arc welding consumables for fabrication of stainless steel magnet cases for 4K service.** Dalder, E.N.C.; Seth, O.W.; Whipple, T.A. (Lawrence Livermore National Lab., CA (USA); Chicago Bridge and Iron Co., Houston, TX (USA); National Bureau of Standards, Boulder, CO (USA)). 30 Jul 1981. 15p. (CONF-810835—5). NTIS, PC A02/MF A01. Order Number DE81028851.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

Of three highly restrained SMA welds made in the flat-position with large diameter Type E316L-15 welding-electrodes supplied by different vendors, two welds showed adequate combinations of 4K tensile and K/sub IC/ properties to be considered for use in manufacture of MFTF-B superconducting magnet-cases. The poor 4K performance of the third SMA weld is explainable, in part, by a combination of higher ferrite level and $N_2$ concentration than in the other two SMA welds. Despite presence of undissolved metallic flux-constituents and porosity in a Type 316L FCMA weld, its 4K K/sub IC/ would be adequate for use on Mirror Fusion Test Facility (MFTF-B). However, its 4K $\sigma y$ was slightly below MFTF-B requirements.

33641 **(UCRL—85877) Electromagnetic launcher: a new weapon.** Brooks, A.L.; Hawke, R.S. (Lawrence Livermore National Lab., CA (USA)). 10 Aug 1981. Contract W-7405-ENG-48. 10p. (CONF-811033—1). NTIS, PC A02/MF A01. Order Number DE81029979.

From 6. international symposium on ballistics; Orlando, FL, USA (22 Oct 1981).

Using electromagnetic (EM) forces to accelerate projectiles is not a new idea; it dates back to the first part of this century. The idea has been revitalized, however, by some recent work done in this area. There are two basic types of electromagnetic accelerators: those that rely on induced currents to provide the Lorentz force that accelerates the projectile (ac), and those that rely on direct current (dc). The ac accelerators are characterized by the potential for very high electrical to mechanical (kinetic energy) conversion efficiencies and relatively low accelerating forces. The dc accelerators produce much higher acceleration, but with lower efficiency. This is the type of interest for weapons applications. The higher accelerations will permit much shorter barrel lengths, minimizing pointing and tracking difficulties. There are several perceived advantages to using EM launching for weapons applications. Higher muzzle velocities than can be achieved with conventional ordnance will minimize the projectile time-of-flight to the target; this is of particular interest for air-defense applications against maneuvering targets and for penetrator launching. The potential for precise current (hence acceleration) control promises lower peak accelerations that the projectile must withstand, and much more precise muzzle velocity control, permitting the use of smart projectiles and continuous zoning for artillery applications. The principles behind EM accelerators, particularly dc accelerators (railguns), the recent history of their development, their advantages for weapons applications, the general requirements, potential problem areas that

must be faced by designers, and the work that has been done by researchers at Livermore and Los Alamos National Laboratories in accelerating 3-g projectiles to 10 km/s, and larger masses to lower velocities are discussed.

**33642 (Y—2227) Digital control of machine tools.** Burleson, R.R. (Oak Ridge Y-12 Plant, TN (USA)). Aug 1981. Contract W-7405-ENG-26. 30p. NTIS, PC A03/MF A01. Order Number DE81029950.

The microcomputer is ideally suited for position-loop calculations and also to replace conventional control equipment. An evolution from the standard numerical-control positioning loop to a system of networked microprocessors is discussed.

**33643 (Y/IA—152) Minicomputer and computer numerical control maintenance.** Bright, G.R. (Oak Ridge Y-12 Plant, TN (USA)). 1981. Contract W-7405-ENG-26. 23p. (CONF-810952—1). NTIS, PC A02/MF A01. Order Number DE81030645.

From 1981 joint electrical engineering seminar for divisions of Union Carbide; Nashville, TN, USA (17 Sep 1981).

The acquisition of large numbers of computers and precision computer numerical controlled machines, combined with a rapidly changing technology, have imposed difficult requirements on the Electrical and Electronics Maintenance Department. This paper discusses the equipment to be maintained, the personnel who perform the maintenance activities, the techniques utilized, the support requirements, and future trends in equipment and maintenance techniques.

**33644 Respirator canister testing for radioiodine.** Wood, G.O. (Los Alamos Scientific Lab., NM). Contract W-7405-ENG-36. *American Industrial Hygiene Association Journal ;* **42**: No. 8, 570-578(Aug 1981).

Radioiodine canisters, cartridges, and their sorbents were tested with vapors of iodine compounds. The purposes were (1) to select a species for use in performance testing, (2) to determine how useful nonradiometric species would be for such testing, (3) to study effects of humidity and other parameters on sorbent performance, and (4) to make limited comparisons of canisters and cartridges currently available from US manufacturers. An experimental apparatus was constructed to generate normal iodine and radioiodine vapors and to detect their penetrations through test beds. Methyl iodide was found to be the most penetrating vapor form. It provides an upper limit to methyl radioiodide penetration. At high humidity, methyl iodide removal deteriorates rapidly. Triethylenediamine-impregnated charcoal is the most effective charcoal tested. Larger beds give higher efficiencies.

**33645 Design and computation of diameter of rock bit.** Zhang, X.; Yang, S.; Chen, F.; Ma, D. *Acta Petrolei Sinica ;* **2**: No. 3, 83-92(Jul 1981). (In Chinese).

As is generally known, the computation value of the diameter of a tricone bit depends on its journal angle, offset, configuration and size of the cone. Expressed in a 4-degree equation, a new functional relation between the essential geometric parameters and the diameter of bit has been derived, on the basis of which a method of checking the bit diameter is proposed. From this 4-degree equation, a 6-degree equation is worked out which may be used to compute some of the geometric parameters, given the diameter of bit. Both equations can be solved with computer, accurate enough for calculation of reasonable tolerance of the geometric parameters.

**33646 (LA-tr—81-19) Magnetic bearings.** Yasuda, I. (Los Alamos National Lab., NM (USA)). 1981. Translation of . Japanese Patent 1978-125,544. 10p. NTIS, PC A02/MF A01. Order Number DE81024201.

The design and operation of a magnetic bearing are disclosed. This invention relates to non-contacting bearings mounted in bodies rotating and high speeds, i.e. to magnetic bearings with concentric cylindrical parts formed on rotating bodies and stationary bodies. A particular construction is disclosed which enhances the dampening effect for suppressing vibrations.

**33647 Coal and ash handling in a typical industrial boiler plant.** Miller, R.J. Cincinnati, OH; Fosdick and Hilmer, Incorporated (1981). 11p. (CONF-8104107—4).

From 12. annual Kentucky industrial coal conference; Lexington, KY, USA (29 Apr 1981).

For the person considering coal as the primary fuel for a new plant, the systems that are unique to coal firing are of particular interest. This paper discussed two of those systems, namely coal handling and ash handling, for a typical, medium size, industrial boiler plant located in this general area. For the purposes of this paper, the typical boiler plant being considered will consist of three boilers each having a capacity of 80,000 lb/hr of steam. The peak load for the plant is assumed to be 160,000 lb/hr. The boilers are stoker fired and are provided with either electrostatic precipitators or baghouses. Based on the peak load of 160,000 lb/hr of steam, coal usage will be four tons per hour maximum per boiler, eight tons per hour total and perhaps 160 tons per day assuming some operation below peak. A plant this size will receive coal either by truck or by rail. The size, type and location of on-site coal storage must be considered initially when designing a coal handling system. Coal storage is either active from which the coal is fed directly to the boilers or reserve in which case the coal is held for future use. The purpose of reserve storage is to guard against interruptions of the coal supply due to strikes, weather or other causes. Reserve storage is usually outdoors, on the ground and uncovered. The amount to be stored should be a minimum of thirty days supply based on the peak month usage. Sixty days supply is quite common. A thirty day supply for this plant would be approximately 4000 tons and would cover an area of approximately 20,000 square feet assuming the coal is piled 10 feet high. A pneumatic system is usually selected for handling ashes and fly ash. Dust control may be repaired at transfer points in handling both coal and ashes.

## 4203 Lasers

*REFER ALSO TO CITATION(S) 33488, 33563, 33564, 33698, 34112, 34175, 34183*

**33648 (LA-UR—81-2568) Status of the free-electron laser experiment at Los Alamos.** Warren, R.W.; Brau, C.A.; Newnam, B.E.; Stein, W.E.; Winston, J.G.; Young, L.M. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 19p. (CONF-8106145—2). NTIS, PC A02/MF A01. Order Number DE81030132.

From 1981 workshop on free electron lasers; Sun Valley, ID, USA (22 Jun 1981).

Main design parameters are presented for the accelerator, the laser, and the wiggler. Four sections are presented that discuss unusual or different features in the design, construction, alignment, and diagnostic parts of the experiment. Up-to-date performance characteristics of the components are described. (MOW)

**33649 (UCRL—15348) XeF pump laser. Final technical report.** (Lawrence Livermore National Lab., CA (USA); Avco-Everett Research Lab., Inc., Everett, MA (USA)). Mar 1980. Contract W-7405-ENG-48. 81p. NTIS, PC A05/MF A01. Order Number DE81030013.

The goal of this program was to demonstrate operation of an XeF laser of adequate energy, efficiency and beam quality at high repetition rates. The specific design goals were: PRF $\geqq$ 10 kHz, energy output $\geqq$ 50 mJ/pulse, efficiency $\geqq$ 0.3%, and beam divergence angle $\leqq$ 20x diffraction limited. In the following sections of this report we will discuss how these goals have been met.

**33650 Laser pulse detector.** Akerman, M.; Mashburn, D.N. (to to Department of Energy). US Patent 4,254,332. 3 Mar 1981. Filed date 13 Aug 1979. vp.

A laser pulse detector is provided which is small and inexpensive and has the capability of detecting laser light of any wavelength with fast response (Less than 5 nanoseconds rise time). The laser beam is focused onto the receiving end of a graphite rod coaxially mounted within a close-fitting conductive, open-end cylindrical housing so that ablation and electric field breakdown of the resulting plasma occurs due to a bias potential applied between the graphite rod and housing. The pulse produced by the breakdown is transmitted through a matched impedance coaxial cable to a re-

cording device. The cable is connected with its central lead to the graphite rod and its outer conductor to the housing.

33651 **Pressure wave charged repetitively pulsed gas laser.** Kulkarny, V.A. (to Dept. of Energy). US Patent Application 201,959. 29 Oct 1980. 10p.

A repetitively pulsed gas laser is described in which a system of mechanical shutters bracketing the laser cavity manipulate pressure waves resulting from residual energy in the cavity gas following a lasing event so as to draw fresh gas into the cavity and effectively pump spent gas in a dynamic closed loop.

33652 **Three-electrode low pressure discharge apparatus and method for uniform ionization of gaseous media.** McLellan, E.J. (to Dept. of Energy). US Patent Application 198,028. 17 Oct 1980. 12p.

Uniform, transverse electrical discharges are produced in gaseous media without the necessity of switching the main discharge voltage with an external device which carries the entire discharge current. A three-electrode low pressure discharge tube is charged across its anode and cathode to below breakdown voltage using a dc voltage source. An array of resistors or capacitors can be made to discharge to the wire screen anode by means of a low energy high voltage pulse circuit producing sufficient preionization in the region between the anode and cathode to initiate and control the main discharge. The invention has been demonstrated to be useful as a $CO_2$ laser oscillator and pulse-smoother. It can be reliably operated in the sealed-off mode.

## 4204 Heat Transfer And Fluid Flow

*REFER ALSO TO CITATION(S) 33312, 33467, 33639*

33653 **(WAPD-TM—1473) Comparisons of turbulent-flow calculations with experiment.** Goldsmith, M. (ed.). (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Aug 1981. Contract AC11-76PN00014. 110p. NTIS, PC A06/MF A01. Order Number DE81031930.

Predictions of the (k, $\epsilon$) turbulence model are compared with experiment for a number of standard cases: fully developed flows in ducts and pipes, developing pipe flow, flows through axisymmetric and rectangular sudden expansions, flows over steps, and axisymmetric swirling flows. In a general way, it appears that the (k, $\epsilon$) model gives good predictions of velocity profiles and good enough estimates of pressure drops to be useful for many engineering applications. Estimates of turbulence intensities and stresses are much less reliable and range from excellent for fully developed flows to unsatisfactory for strongly swirling flows.

## 4205 Materials Testing

33654 **(DP-MS—81-12) Tritium autoradiography.** Caskey, G.R. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 28p. (CONF-811037—1). NTIS, PC A03/MF A01. Order Number DE81030521.

From TMS/AIME fall meeting on advanced techniques for the characterization of hydrogen in metals; Louisville, KY, USA (11 Oct 1981).

Hydrogen distribution and diffusion within many materials may be investigated by autoradiography if the radioactive isotope tritium is used in the study. Tritium is unstable and decays to helium-3 by emission of a low energy (18 keV) beta particle which may be detected photographically. The basic principles of tritium autoradiography will be discussed. Limitations are imposed on the technique by: (1) the low energy of the beta particles; (2) the solubility and diffusivity of hydrogen in materials; and (3) the response of the photographic emulsion to beta particles. These factors control the possible range of application of tritium autoradiography. The technique has been applied successfully to studies of hydrogen solubility and distribution in materials and to studies of hydrogen damage.

33655 **(RFP—3208) Ultrasonic evaluation of U - 3/4 Ti penetrators by amplitude and frequency analysis.** Michael, M.D. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1981. Contract AC04-76DP03533. 29p. (CONF-810839—1). NTIS, PC A03/MF A01. Order Number DE81028933.

From AF/DARPA review of progress in quantitative NDE; Boulder, CO, USA (2 Aug 1981).

Portions of document are illegible.

Tests have been conducted to evaluate the ultrasonic amplitude and frequency response of heat treated and unheat treated U - 3/4 Ti. In addition commercial instrumentation and transducers were characterized. Amplitute results indicate nearly uniform response from unheated treated material and wide variations in response from heat treated material. Frequency spectrum analysis reveals a filtering effect of the higher frequency components of the ultrasonic wave, especially in the heat treated material. Characterization of commercial instrumentation revealed a nonuniform actual response as compared to that indicated on the equipment. These tests indicate that if uniform results are to be achieved throughout industry, careful control and characterization of all test parameters and components must be maintained.

## 4207 Vacuum Engineering

*REFER ALSO TO CITATION(S) 33630*

## 4208 Electronic Circuits And Devices

*REFER ALSO TO CITATION(S) 33566*

33656 **Clock distribution system for digital computers.** Loomis, H.H.; Wyman, R.H. (to Department of Energy). US Patent 4,253,065. 24 Feb 1981. Filed date 5 Dec 1978. vp.

An apparatus is disclosed for eliminating, in each clock distribution amplifier of a clock distribution system, sequential pulse catch-up error due to one pulse "overtaking" a prior clock pulse. The apparatus includes timing means to produce a periodic electromagnetic signal with a fundamental frequency having a fundamental frequency component v'01(T); an array of N signal characteristic detector means, with detector means no. 1 receiving the timing means signal and producing a change-of-state signal v1(T) in response to receipt of a signal above a predetermined threshold; N substantially identical filter means, one filter means being operatively associated with each detector means, for receiving the change-of-state signal vn(T) and producing a modified change-of-state signal v'n(T) (N 1, . . . , n) having a fundamental frequency component that is substantially proportional to v'01(T- theta n(T) with a cumulative phase shift theta n(T) having a time derivative that may be made uniformly and arbitrarily small; and with the detector means n+1 (1 < or = n<n) receiving a modified change-of-state signal vn(T) from filter means no. N and, in response to receipt of such a signal above a predetermined threshold, producing a change-of-state signal vn+1(T).

33657 **(SAND—80-0451) High-voltage air-core pulse transformers.** Rohwein, G.J. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 34p. NTIS, PC A03/MF A01. Order Number DE81030999.

High voltage air core pulse transformers are best suited to applications outside the normal ranges of conventional magnetic core transformers. In general these include charge transfer at high power levels and fast pulse generation with comparatively low energy. When properly designed and constructed, they are capable of delivering high energy transfer efficiency and have demonstrated superior high voltage endurance. The general types designed for high voltage pulse generation and energy transfer applications are described. Special emphasis is given to pulse charging systems which operate up to the multi-megavolt range. (WHK)

33658 **(SAND—81-0754C) High voltage, magnetically switched pulsed power systems.** VanDevender, J.P.; Reber, R.A. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 12p. (CONF-810659—28). NTIS, PC A02/MF A01. Order Number DE81026290.

From 3. IEEE international pulsed power conference; Albuquerque, NM, USA (1 Jun 1981).

The principles of magnetic switching are briefly described. Then the results of experiments on the following substantive topics for magnetic switching are presented: material properties and how they relate to switch performance, risetime limitations, and core insulation. Magnetic switching is then evaluated from a system perspective. An idealized pulse power system with 200 kJ or stored energy and a 40 ns output pulse is examined. The multi-megavolt electrical insulation requirements impose limitations on the switches. The cost of the magnetically switched system exceeds the cost of the conventional superpower generator system by up to 75%. The potential for reliability, reproducibility, and repetitive pulse capability must be evaluated for each application to offset the increased cost.

33659 **Apparatus for generating nonlinear pulse patterns.** Nakamura, M. (to to Department of Energy). US Patent 4,255,793. 10 Mar 1981. Filed date 11 Jun 1979. vp.

Apparatus is described for generating a plurality of nonlinear pulse patterns from a single linear pulse pattern. A first counter counts the pulses of the linear pulse pattern and a second counter counts the pulses of the nonlinear pulse pattern. A comparator compares the counts of both counters, and in response to an equal count, a gate is enabled to gate a pulse of the linear pattern as a pulse of the nonlinear pattern, the latter also resetting the first counter. Presettable dividers divide the pulses of each pattern before they are counted by the respective counters. Also, apparatus for generating a logarithmic pulse pattern from a linear pulse pattern to any log base. In one embodiment, a shift register is used in place of the second counter to be clocked by each pulse of the logarithmic pattern to generate the pattern. In another embodiment, a memory stores the logarithmic pattern and is addressed by the second counter which is clocked by the pulses of the logarithmic pulse pattern.

## 4209 Waste Processing Plants And Equipment

*REFER ALSO TO CITATION(S) 33466, 33474, 33475, 33482*

## 4210 Combustion Systems

*REFER ALSO TO CITATION(S) 32803, 32895, 32947, 32950, 32951, 32977, 33265*

33660 **(EPRI-CS—1935) Studies of in-bed corrosion in a pressurized fluidized-bed combustor. Final report.** Lane, G.J.; Hilliard, P.T.; Blackaller, G.S.; Tydd, C.B.; Cairns, A.J. (Fluidised Combustion Contractors Ltd., East Grinstead, Sussex (UK)). Jul 1981. 489p. NTIS, PC A21/MF A01. Order Number DE81904226.

This report presents results of a corrosion investigation on candidate in-bed tube materials associated with a 1000-hour test programme in a pressurized fluidized bed combustion (PFBC) facility. Details of the test facility, nominal operating conditions and corrosion probes are given in the main report. Three organizations carried out the corrosion work and detailed results from their metrology and metallographic examinations are given in the appendices. The main report summarizes these findings, draws together the discussion and conclusions from each organization, and provides a common approach to the interpretation of the results. The results indicate that the PFBC environment of the test rig used for the 1000 hour test is less aggressive than AFBC environments. The performances of both Incoloy 800H and TP 347 SS are sufficiently good to suggest these materials may be suitable for use as superheater tubes, with Incoloy 800H performing marginally better.

33661 **Corrosion data for uncooled alloys in the bed of an atmospheric fluidized-bed boiler.** *Materials and Components in Fossil Energy Applications ;* No. 23, 1-4(1 Aug 1981).

The major conclusions drawn from the results of this particular corrosion test were that: above the coal feed ports, Alloys 304, 310, and 800 were the most resistant. However, Alloys 800 and 310 were subject to catastrophic attack at points of contact with Alloy 600. All three alloys formed subscale sulfides; in oxidizing zones away from the coal feed ports, only Inconel 671 suffered especially rapid attack. The lower chromium (16 to 19%) alloy specimens - C276, 347, 304, 18SR, and 430 - suffered some internal sulfidation, and both the 304 and 310 rods beneath the specimen probe suffered rapid penetration; on the basis of this test alone, alloys containing more than 40% nickel should not be considered for use within the bed of FBC units. Alloys containing 20 to 40% nickel should be evaluated very carefully, giving consideration to possible occurrence of rapid attack under low oxygen conditions and in crevice areas; austenitic stainless steels appear to be promising candidates for uncooled, in-bed applications. Extended testing (2,000 to 10,000 hour) of these alloys is needed.

33662 **Investigation of high temperature corrosion of Ni-Cr alloy by the burning hydrocarbons.** Hou, X.; Lin, F.; Yang, Y.; Zhan, Y.; Ran, G.; Li, X. *Acta Petrolei Sinica ;* **2**: No. 3, 93-102(Jul 1981). (In Chinese).

In the operation of aviation gas turbine engines using hydrocarbon fuels, pitting corrosion on heat resistant Ni-Cr alloy parts in the combustion chamber has been observed. Experiments indicate that the pitting corrosion is not caused by impurities in the fuel but by the hydrocarbons. Investigation of the effect of various gas components on the heat resistant Ni-Cr alloys and nickel, of the carbon deposits formed on the alloy surface and of the changes in alloy composition of the attacked parts reveals that the bulk alloy is attacked by the burning hydrocarbons containing methane and carbon monoxide through carburization of the alloy which give rise to the precipitation of chromium carbides and the formation of nickel-rich spots. As a consequence of the catalytic action of nickel on hydrocarbons, dehydrocondensation reactions take place and the corroded surface is readily covered with carbon by graphitizing action. It is theorized that pitting corrosion of the Ni-Cr alloys occur through these processes. It can be inhibited by the addition of some sulfur, arsenic or selenium compounds into the fuels to hinder the undesired catalytic dehydrocondensation reactions.

33663 **Fluidized-bed-fired industrial boilers.** Leon, A.M.; McCoy, D.E. Lexington, Kentucky; University of Kentucky (1981). 11p. (CONF-8104107—6).

From 12. annual Kentucky industrial coal conference; Lexington, KY, USA (29 Apr 1981).

E. Keeler Company and Dorr-Oliver, Inc. have joined to design, market and manufacture atmospheric fluidized-bed-fired boilers. The first contract, called Shamokin, was a 23,400 lb/hr unit fired with anthracite culm having a heating value of 4000 Btu/lb and 67% ash. The Department of Energy sponsored this plant as a demonstration project. Boiler erection is nearly complete and start-up is scheduled for mid-1981. In conjunction with the Shamokin project, a line of fluidized-bed-fired boilers to 250,000 lb/hr has been developed for conventional solid fuels. The development of fluidized-bed-fired, industrial boilers is in its very early stages. At this point, it is not possible for any manufacturer to claim extensive operating experience with any particular design under the varied applications normal to industrial watertube boilers. Many different designs and approaches will develop over the next few years and until there has been some operating experience, it is not possible to evaluate just what share of the future industrial boiler market will utilize fluidized-bed firing.

## 4220 Underground Engineering

*REFER ALSO TO CITATION(S) 33032, 33033, 33925*

## 4230 Marine Engineering

33664 **(AD-A—092605) Engineering for deep sea drilling for scientific purposes. Final report.** (National Academy of Sciences, Washington, DC (USA)). 1980. 113p. (NSF-C—310). National Research Council, Marine Board, Washington, DC. Order Number DE81903750.

Since its inception in 1968, the Deep Sea Drilling Program sponsored by the National Science Foundation (NSF) has expanded our knowledge in the earth sciences by verifying the plate tectonic theory of the earth's crustal dynamics. Now, NSF is considering whether to extend the program's scope and duration. Under a plan proposed by NSF, the program would seek to recover sample cores from geological formations located as much as 20,000 feet (6 kilometers) below the ocean floor in water up to 13,000 feet (4 kilometers) deep. The demands imposed by such ocean depths, drilling penetration, and personnel and environmental safeguards exceed today's operational experience as well as the capability of available systems and equipment. Using current technology, the seabed can be drilled to as much as 6000 feet (1.8 kilometers). Still, no insurmountable technical barriers are foreseen that should prevent NSF from achieving its drilling objectives. In doing this, the cost of developing the equipment to meet the requirements of the proposed drilling is likely to amount to $84 million.

33665 **Cost control for offshore structures.** Cascio, E.L. (Northcrofts Europe, London, England). *Engineering Costs and Production Economics ;* **5**: No. 2, 101-105(Sep 1980).

Design overruns and late delivery of materials and equipment are frequently the main causes of delays and cost increases in engineering projects. The impact on cost and time is likely to be particularly critical in the case of offshore projects which are affected by narrow weather windows. Starting construction work on time in these cases is of prime importance for the success of the project. However, venturing into the construction phase without proper appraisal and definition of the work scope and on the basis of a guarantee of cost reimbursement has frequently proved to be the road to disaster.

### 4240 Pollution Control Equipment

*REFER ALSO TO CITATION(S) 32862, 33273, 33763*

### 4250 Power Cycles

*REFER ALSO TO CITATION(S) 33484, 33485*

## 43 PARTICLE ACCELERATORS

### 4301 Design, Development, And Operation

*REFER ALSO TO CITATION(S) 34110, 34111, 34113*

### 4302 Beam Dynamics, Field Calculations, And Ion Optics

*REFER ALSO TO CITATION(S) 33670*

33666 **Beam emittance growth caused by transverse deflecting fields in a linear accelerator.** Chao, A.W.; Richter, B.; Yao, C.Y. (Stanford Linear Accelerator Center, CA (USA)). *Nuclear Instruments and Methods ;* **178**: No. 1, 1-8(1 Dec 1980).

The effect of the beam-generated transverse deflecting fields on the emittance of an intense bunch of particles in a high-energy linear accelerator is analyzed in this paper. The equation of motion is solved by a perturbation method for cases of a coasting beam and a uniformly accelerated beam. The results are applied to obtain some design tolerance specifications for the recently proposed SLAC Single Pass Collider.

33667 **Particle trajectories in quadrupole fringe fields.** Colton, E.; Fenster, S. (Argonne National Lab., IL (USA). Accelerator Research Facilities Div.). *Nuclear Instruments and Methods ;* **177**: No. 2/3, 589-590(15 Nov 1980).

The differential equations for particle motion in a linear fringe field are written in a form directly solved by the Airy functions A and B. Matrix transformations are presented.

33668 **Design features and focal properties of simple three element two- or three-dimensional lens systems for decelerating intense ion beams to very low energies.** Alton, G.D.; Roberto, J.B.; White, C.W.; Zuhr, R.A. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods ;* **177**: No. 2/3, 273-280(15 Nov 1980).

This paper describes the design features and focal properties of a simple two- or three-dimensional lens system for decelerating ion beams of variable intensity to very low energies (<= 100 → >= 2000 eV). The characteristics of the lenses were determined by numerically computing the electrostatic field distributions and particle trajectories through specified electrode configurations. The results of computer simulation studies are presented which illustrate the influence of space charge, angular distribution, and aperture size on the focal properties of the lenses. The measured focal properties of a lens designed according to such calculations agree well with the predicted values.

### 4303 Auxiliaries And Components

*REFER ALSO TO CITATION(S) 33666, 34010*

33669 **(BNL—29990) Multiparticle magnetic spectrometer with dE/dx and TRD particle identification.** Lindenbaum, S.J.; Longacre, R.S. (Brookhaven National Lab., Upton, NY (USA); City Coll., New York (USA)). 1981. Contract AC02-76CH00016. 11p. (CONF-810759—1). NTIS, PC A02/MF A01. Order Number DE81030567.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Recent advances in detector development by BNL, CCNY and other groups have made possible new designs of fast high resolution large effective solid angle magnetic multiparticle spectrometers with excellent particle tracking, momentum measurement, and identification capability. These new spectrometers are relatively compact and relatively low cost electronics have been developed for them. Thus the cost is relatively low. These techniques are applied here primarily for design of spectrometers for low p/sub t/ and other physics (at moderate and even high p/sub t/) in the ISABELLE small angle hall. However, one should keep in mind that these techniques can be utilized in many other applications.

33670 **(CONF-810944—1) Helical axial injection concept for cyclotrons.** Hudson, E.D. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 3p. NTIS, PC A02/MF A01. Order Number DE81029653.

From 9. international conference on cyclotrons and their applications; Caen, France (7 Sep 1981).

A concept for an external beam injection system using a helical beam path centered on the cyclotron axis is described. This system could be used to couple two accelerator stages, with or without intermediate stripping, in cases where conventional axial injection or radial injection are not practical.

33671 **(LA-UR—81-2571) Why high-capacity manipulators and lead glass windows.** Grisham, D.L.; Lambert, J.E. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-810606—96). NTIS, PC A02/MF A01. Order Number DE81030245.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

The Monitor remote-handling system was developed to maintain the main experimental beam line at the Clinton P. Anderson Meson Physics Facility (LAMPF) of the Los Alamos National Laboratory. The technology and operating experience developed at LAMPF can be applied to other areas where handling of radioactive, hazardous, or toxic materials is required. These could include radiological incidents similar to Three Mile Island and toxic material spills, such as chlorine tank car derailments, where no provision for remote-handling exists. The technology can also be applied to routine radioactive remote-handling operations now conducted in conventional hot cells. These operations are normally done using mechanical master-slave manipulators with viewing through lead glass windows. The conventional facility can be replaced by a plain shielded box with an equivalent of the front end of Monitor inside. Master-slave manipulators of the future should be of 10-kg capacity

with a force-reflection threshold of 0.2, minimum size, and provision for total sealing.

**33672 (ORNL/TM—7886) ORELA electron guns.** Christian, O.W.; Lewis, T.A. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 29p. NTIS, PC A03/MF A01. Order Number DE81030703.

The most recent information concerning the production and performance of ORELA electron guns is presented. Included are descriptions of procedures for gun fabrication, cathode conditioning and high voltage processing. Highlights of the performance characteristics are also included.

**33673 (SLAC-TN—81-5) Study of the emission performance of high-power klystrons: SLAC XK-5.** Zhao, Y. (Stanford Linear Accelerator Center, CA (USA)). Jul 1981. Contract AC03-76SF00515. 51p. NTIS, PC A04/MF A01. Order Number DE81030177.

There are hundreds of high power klystrons operated in the Linac gallery and about fifty to sixty tubes fail every year. The lifetime ranges from a few thousand up to seventy thousand hours except those which fail during an early period. The overall percentage of failures due to emission problems is approximately 25%. It is also noted that a 10% increase in mean lifetime of klystrons will reduce the overall cost per hour as much as a 10% increase in efficiency. Therefore, it is useful to find some method to predict the expected life of an individual tube. The final goal has not been attained yet, but some useful information was obtained. It is thought that this information might be helpful for those people who will study this subject further.

**33674 Room temperature harmonic analysis of superconducting energy saver quadrupoles.** Fisk, H.E.; Peters, R.; Raja, R. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics ;* **MAG-17**: No. 1, 420-423(Jan 1981). (CONF-800980—).

From Applied superconductivity conference; Santa Fe, NM, USA (29 Sep 1980).

The multipole structure of Fermilab Energy Saver quadrupoles is obtained from low current, room temperature measurements using a rotational Morgan coil and lock-in amplifier. Multipole data are presented for the first forty Tevatron quadrupoles. 5 refs.

**33675 State of the energy doubler.** Lundy, R.A. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics ;* **MAG-17**: No. 1, 709-712(Jan 1981). (CONF-800980—).

From Applied superconductivity conference; Santa Fe, NM, USA (29 Sep 1980).

The Energy Doubler, a large scale superconducting accelerator, proposed as a construction project to the Department of Energy is dealt with. An overview of the developments in this area during the last two years is presented. 5 refs.

**33676 Two cell double systems test.** Koepke, K.; Rode, C.; Tool, G.; Flora, R.H.; Jostlein, H.; Saarivirta, J.; Kuchnir, M. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics ;* **MAG-17**: No. 1, 713-716(Jan 1981). (CONF-800980—).

From Applied superconductivity conference; Santa Fe, NM, USA (29 Sep 1980).

A superconducting magnet system testing area has been constructed above ground at the B12 location of the Fermilab main accelerator which facilitates the testing and development of superconducting magnet systems prior to committing their design to the full scale production of the Doubler accelerator. Test results and operating experience of this system are reported. 4 refs.

**33677 Improved extraction of negative ion beams from the inverted sputter source.** Billquist, P.J.; Yntema, J.L. (Argonne National Lab., IL (USA)). *Nuclear Instruments and Methods ;* **178**: No. 1, 9-10(1 Dec 1980).

The efficiency of negative ion extraction from the inverted sputter source is improved by distributing the acceleration potential and adding a source lens.

## 4304 Storage Rings

**33678 (BNL—30005) Production and use of high-grade silicon-diode temperature sensors.** Sondericker, J. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 8p. (CONF-810835—25). NTIS, PC A02/MF A01. Order Number DE81030547.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

With todays tight budgets and increasing costs, helium refrigeration system engineers must design for increased cycle efficiency and shave the refrigerators excess capacity to reduce capital costs and operating expenses. For a project such as ISABELLE this task is noteworthy since the load is not one easily calculable dewar but 1100 magnets supplied by long transfer lines, inteconnecting links and multitudes of lead pots. Realizing the consequences, ISA's cryogenic group has been measuring heat loads of magnets and associated equipment and has confidence in their estimates.

**33679 (BNL—30006) Cycle design for the ISABELLE helium refrigerator.** Brown, D.P.; Schlafke, A.P.; Wu, K.C.; Moore, R.W. (Brookhaven National Lab., Upton, NY (USA); Koch Process Systems, Westborough, MA (USA)). 1981. Contract AC02-76CH00016. 8p. (CONF-810835—21). NTIS, PC A02/MF A01. Order Number DE81030551.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

The superconducting magnets for the ISABELLE storage ring/accelerator are designed to be operated at 3.8°K using a forced-flow supercritical helium cooling system. The ISABELLE refrigerator has been designed subject to these special requirements. The design output is 13.65 KW of refrigeration below 4.2°K (for cooling the magnet and distribution system), 55 KW at 55°K (to cool heat shields for the whole system) and 100 g/s of liquefaction (for magnet power leads cooling). The system incorporates a subcooler section that produces liquid helium at 5.3 atm and 2.6 K and circulates it through the loads, and a Claude-type main refrigerator section. The main refrigerator section has five stages of cooling, with four of them below liquid nitrogen temperature. Liquid nitrogen precooling is not used. With 60% isothermal compressors the efficiency of the refrigerator system will be about 26% of Carnot.

**33680 (BNL—30008) Transient response of a thermal buffer: a study for ISABELLE.** Schneider. W.J. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 8p. (CONF-810835—23). NTIS, PC A02/MF A01. Order Number DE81030549.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

Operation of the superconducting magnets in ISABELLE may necessitate rapid cooldown and warmup from ambient (300K) to liquid helium temperature (3K) to meet the requirements of the experimental program. Similarly, unprogrammed temperature excursions can also occur due to operator error or equipment malfunction. The coal bore tube of the magnets has a small mass relative to the more massive iron laminations and the stainless steel support tube. In addition the magnet coil, in thermal contact with the cold bore tube, has excellent heat transfer to the helium flowing through it compared to the iron mass. These two factors, mass and heat transfer, dictate that the cold bore tube will follow the temperature of the coolant more closely than the iron and hence substantial temperature gradients can exist. If the temperature difference between the coolant and the iron in the magnet exceeds 44K stress failure may occur to either the cold bore tube or the magnet dewar end cap. To preclude such failures from occuring at least two options are available. One method is to modify the magnet design by introducing flexibility between the bore tube and the end plate. Another is to introduce an insensitive thermal mass or buffer as has been suggested by Shutt, at the inlet of a sextant ahead of the first magnets. This paper describes the latter method, the design and transient response of a buffer during cooldown.

**33681 (BNL—30009) Analysis of cooldown performance for ISABELLE helium refrigerator.** Wu, K.C.; Brown, D.P.; Moore, R.W. (Brookhaven National Lab., Upton, NY (USA); Koch Process Systems, Westborough, MA (USA)). 1981. Contract AC02-76CH00016. 7p. (CONF-810835—22). NTIS, PC A02/MF A01. Order Number DE81030548.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

The ISABELLE refrigerator was designed to provide cooling for 1000 superconducting magnets. It has the dual duty of providing cooling at steady-state operating conditions and to cooldown massive magnets from ambient temperature. During the cooldown, tremendous quantities of heat ($\sim 4.8 \times 10^{11}$ J) must be removed from the magnets ($5.9 \times 10^{9}$ gm of iron) and 75,000 liters of cold helium must be supplied to fill the system. In the planning for ISABELLE, this procedure has been estimated to require approximately two weeks. Because of this long cooldown time and the fact that during cooldown the refrigerator will be operated quite differently from its steady-state design configuration, it is important to maximize the cooling capacity and identify the cooldown procedure.

**33682 (BNL—30010) Heat-load measurement of prototype cryogenic magnets and leads for the ISABELLE project.** Werner, A.P.; Brown, D.P.; Schneider, W.J. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 8p. (CONF-810835—24). NTIS, PC A02/MF A01. Order Number DE81030550.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

A major feature in the cryogenic system development program for ISABELLE is the measurement of the heat loads of prototypical hardware. In particular, superconducting magnet assemblies, magnet power leads and magnet power lead vessels have been measured. In each of these cases it has been possible to build equipment which has a heat load equal to or less than the allowance for it in the heat load budget.

**33683 (BNL—30011) MAGCOOL: the production cooling facility for ISABELLE magnets.** Bamberger, J.A.; Afrashteh, M.; Brown, D.P.; Schneider, W.J.; Sondericker, J.H.; Wu, K.C. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 8p. (CONF-810835—19). NTIS, PC A02/MF A01. Order Number DE81030554.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

The ISABELLE proton accelerator uses over one thousand superconducting magnets to guide the particle beams in two circular rings, 3.8 km in circumference. Prior to their installation in the tunnel all magnets must be tested and measured at their 3.8 K operating temperature. This paper describes the refrigeration system, called MAGCOOL, to accomplish this task.

**33684 (BNL—30013) Design of 24.8-kW, 3.8 K cryogenic system for ISABELLE.** Brown, D.P.; Afrashteh, M.; Bamberger, J.A.; Fresco, A.; Schlafke, A.P.; Schneider, W.J.; Sondericker, J.H.; Werner, A.; Wu, K.C. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 6p. (CONF-810835—20). NTIS, PC A02/MF A01. Order Number DE81030555.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

ISABELLE will consist of two proton accelerator/storage rings in a common tunnel. There will be 1084 superconducting magnets installed in the 3.8 km circumference tunnel. The protons will be accelerated to an energy of 400 GeV in each ring and stored for 24 hours. The two beams are counter-rotating and intersect at six places around the ring. The particles which emerge from proton interactions at these intersecting points are studied using various types of detectors.

# 44 INSTRUMENTATION

**33685 (DOE/ER—0104) Definitions of CAMAC terms.** (Department of Energy, Washington, DC (USA)). Jul 1981. 20p. NTIS, PC A02/MF A01. Order Number DE81028247.

This report provides definitions and concise explanations of terms used in documents concerning the CAMAC modular instrumentation and digital interface system as adopted by the US Department of Energy, its predecessor agencies and the ESONE Committee of European Laboratories, and subsequently adopted as Standards of the Institute of Electrical and Electronics Engineers (IEEE) and the American National Standards Institute (ANSI).

## 4401 Radiation Instrumentation

*REFER ALSO TO CITATION(S) 33060, 33577, 33637, 33765, 33824, 33838, 34009*

**33686 (BNL—29923) Fine-grained hodoscopes based on scintillating optical fibers.** Borenstein, S.R.; Strand, R.C. (Brookhaven National Lab., Upton, NY (USA); City Univ. of New York, NY (USA)). 1981. Contract AC02-76CH00016. 12p. (CONF-8106150—1). NTIS, PC A02/MF A01. Order Number DE81029316.

From CESRII workshop; Ithaca, NY, USA (18 Jun 1981).

In order to exploit the high event rates at ISABELLE, it will be necessary to have fast detection with fine spatial resolution. The authors are currently constructing a prototype fine-grained hodoscope, the elements of which are scintillating optical fibers. The fibers have been drawn from commercially available plastic scintillator which has been clad with a thin layer of silicone. So far it has been demonstrated with one mm diameter fibers, that with a photodetector at each end, the fibers are more than 99% efficient for lengths of about 60 cm. The readout will be accomplished either with small diameter photomultiplier tubes or avalanche photodiodes used either in the linear or Geiger mode. The program of fiber development and evaluation is described. The status of the APD as a readout element is discussed, and an optical encoding readout scheme is described for events of low multiplicity.

**33687 (BNL—29940) Applications of bent cylindrical mirrors to x-ray beamlines.** Heald, S.M. (Brookhaven National Lab., Upton, NY (USA)). Jul 1981. Contract AC02-76CH00016. 11p. (CONF-810750—5). NTIS, PC A02/MF A01. Order Number DE81029918.

From 2. national conference on synchrotron radiation instrumentation; Ithaca, NY, USA (15 Jul 1981).

Bent cylindrical mirrors are considered as substitutes for paraboloidal and ellipsoidal mirrors in x-ray beamlines. Analytic and raytracing studies are used to compare their optical performance with the corresponding ideal elements. Particular emphasis is placed on obtaining the practical limitations in the application of bent cylinders to typical beamline configurations.

**33688 (BNL—30031) Plans for Brookhaven Fastbus during the next $\pi \times 10^{16}$ nanoseconds.** Leipuner, L.B.; Larsen, R.; Makowiecki, D.; Morse, W.; Rudolf, T.; Sims, W.; Blatt, S.; Campbell, M.; Kasha, H.; Schmidt, M. (Brookhaven National Lab., Upton, NY (USA); Yale Univ., New Haven, CT (USA)). 26 Aug 1981. Contract AC02-76CH00016. 4p. NTIS, PC A02/MF A01. Order Number DE81030335.

During this period new modules and devices will be built to be used in Experiment 749 at the A.G.S. Included will be ~ 200 channels of A-D converters for Pb-Glass Cerenkov counters, 2000 channels of proportional wire chamber readout, cable segments, segment interconnects, a new unibus interface, and a new on-segment processor. These items and perhaps others will be ready by the end of 1981.

**33689 (DOE/EV/04969—3) Myocardial perfusion scintigraphy using a new technique, the mesh chamber. Progress report, September 1, 1978-May 1, 1981.** Osborne, L.S.; Holman, B.L. (Massachusetts Inst. of Tech., Cambridge (USA); Harvard Medical School, Boston, MA (USA). Brigham and Women's Hospital). Aug 1981. Contract AS02-78EV04969. 16p. NTIS, PC A02/MF A01. Order Number DE81027995.

Myocardial perfusion scintigraphy performed after the injection of a potassium analogue during exercise promises to be a useful technique to detect transiently ischemic myocardium due to coro-

nary artery disease. Initial results with potassium-43 and thallium-201 have been reasonably satisfying; the false-negative rate has been too high, however, for use as the primary screening tool for early coronary artery disease. Rubidium-82, a positron emitting tracer, is an exceedingly promising substitute for the gamma-emitting potassium analogues. It has potential for a long shelf life, and because of its short physical half life, will enable multiple sequential images. The primary limitation in the implementation of this new technique for the screening of patients with coronary artery disease is the lack of a high resolution, relatively inexpensive, positron detecting system. The positron multiwire proportional counter will solve this problem. The dispersion of the absorbing material will be achieved by stringing wires of high Z material, such as tungsten, in a cross pattern. By stacking the wires, an efficiency of 30% can be obtained for 0.5 MeV photons. The wire layers will be at graded voltages; the ionization from the photoelectrons is thereby drifted through the stack and picked up by sense wires operating in the proportional mode. Resolutions within the 3 mm range should also be achievable. An advantage of positron annihilation detectors is that they are self collimating. The increased solid angle and therefore sensitivity is at least $10^3$ or more. Furthermore, the acquisition of events over a multiplicity of angles will allow 3-dimensional reconstruction. The combination of large solid angle, high efficiency, and a short source half life minimizes radiation dose to the patient. (ERB)

33690 **(SLAC-PUB—2642) Design and performance of the new cathode readout proportional chambers in LASS.** Aiken, G.; Aston, D.; Dunwoodie, W. (Stanford Linear Accelerator Center, CA (USA); Carleton Univ., Ottawa, Ontario (Canada); Nagoya Univ. (Japan)). Oct 1980. Contract AC03-76SF00515. 28p. (CONF-801103—63). NTIS, PC A03/MF A01. Order Number DE81028097.

From IEEE nuclear science symposium; Orlando, FL, USA (5 Nov 1980).

The design and construction of a new proportional chamber system for the LASS spectrometer are discussed. This system consists of planar and cylindrical chambers employing anode wire and cathode strip readout techniques. The good timing characteristics of anode readout combine with the excellent spatial resolution of cathode readout to provide powerful and compact detectors. Preliminary resolution data are presented along with operating characteristics of the various devices.

33691 **(SLAC-TN—81-6) Coordinate measurement by current division: a simple system for multichannel detectors.** Gottschalk, B. (Stanford Linear Accelerator Center, CA (USA)). Aug 1981. Contract AC03-76SF00515. 33p. NTIS, PC A03/MF A01. Order Number DE81030176.

A simple current-division scheme is described based on an unorthodox connection of the 733 amplifier chip: a common-base input can be obtained by grounding the normal inputs and driving a gain control terminal. With ganged multiwire chambers detecting cosmic rays in the proportional region, under realistic operating conditions (charge ~ 2 picocoulombs per gap), the resolution is about 2% of full length. Calibration procedures are discussed, as are the effects of changing various parameters.

33692 **Radiation detection system using semiconductor detector with differential carrier trapping and mobility.** Whited, R.C. (to Department of Energy). US Patent 4,253,023. 24 Feb 1981. Filed date 13 Apr 1979. vp.

A system for obtaining improved resolution in relatively thick semiconductor radiation detectors, such as HgI2, which exhibit significant hole trapping. Two amplifiers are used: the first measures the charge collected and the second the contribution of the electrons to the charge collected. The outputs of the two amplifiers are utilized to unfold the total charge generated within the detector in response to a radiation event.

33693 **Hand and shoe monitor using air ionization probes.** Fergus, R.W. (to Department of Energy). US Patent 4,253,025. 24 Feb 1981. Filed date 14 Sep 1978. vp.

A hand and shoe radiation monitor is provided which includes a probe support body defining a plurality of cells, within each cell there being an ionization probe. The support body provides structural strength for protecting the ionization probes from force applied to the support body during a radiation monitoring event. There is also provided a fast response time amplifier circuit for the output from the ionization probes.

33694 **Imaging alpha particle detector.** Anderson, D.F. US Patent Application 202,042. 29 Oct 1980. 20p.

A method and apparatus for detecting and imaging alpha particles sources is described. A dielectric coated high voltage electrode and a tungsten wire grid constitute a diode configuration discharge generator for electrons dislodged from atoms or molecules located in between these electrodes when struck by alpha particles from a source to be quantitatively or qualitatively analyzed. A thin polyester film window allows the alpha particles to pass into the gas enclosure and the combination of the glass electrode, grid and window is light transparent such that the details of the source which is imaged with high resolution and sensitivity by the sparks produced can be observed visually as well. The source can be viewed directly, electronically counted or integrated over time using photographic methods. A significant increase in sensitivity over other alpha particle detectors is observed, and the device has very low sensitivity to gamma or beta emissions which might otherwise appear as noise on the alpha particle signal.

33695 **Contribution of carbon interactions to the neutron counting efficiency of organic scintillators.** Drosg, M. (Vienna Univ. (Austria). Inst. fuer Experimentalphysik); Drake, D.M.; Lisowski, P. (Los Alamos Scientific Lab., NM (USA)). *Nuclear Instruments and Methods ;* **176**: No. 3, 477-480(15 Oct 1980).

The neutron counting efficiency of an NE-213 detector was measured for neutron energies up to 15 MeV using biases at 0.3 and 2.0 MeV neutron energies. For the lower bias, nonelastic carbon interactions contribute appreciably to the efficiency at energies as low as 5.5 MeV.

## 4403 Miscellaneous Instruments

*REFER ALSO TO CITATION(S) 32806, 33345, 33748, 33763, 33936, 33964*

33696 **(BDX—613-2668) Automation of a specimen stage in an electron microprobe. Final report.** Pedersen, T.E. (Bendix Corp., Kansas City, MO (USA)). Sep 1981. Contract AC04-76DP00613. 17p. NTIS, PC A02/MF A01. Order Number DE81030691.

The specimen stage of the electron microprobe at Bendix Kansas City has been automated. Hardware was constructed to match stepping motors to the stage axis drives; axis drive mechanisms were overhauled; and spatial resolution on each axis was determined.

33697 **(EGG—1183-1777) Laboratory and field portable system for calibrating airborne multispectral scanners.** Kuhlow, W.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC08-76NV01183. 5p. (CONF-810810—23). NTIS, PC A02/MF A01. Order Number DE81029740.

From SPIE international symposium; San Diego, CA, USA (24 Aug 1981).

Manufacturers of airborne multispectral scanners suggest procedures for calibration and alignment that are usually awkward and even questionable. For example, the procedures may require: separating the scanner from calibration and alignment sources by 100 feet or more, employing folding mirrors, tampering with the detectors after the procedures are finished, etc. Under the best of conditions such procedures require about three hours yielding questionable confidence in the results; under many conditions, however, procedures commonly take six to eight hours, yielding no satisfactory results. EG & G, Inc. has designed and built a calibration and alignment system for airborne scanners which solves those problems, permitting the procedures to be carried out in about two to three hours. This equipment can be quickly disassembled, transported with the scanner in all but the smallest single engine aircraft, and reassembled in a few hours. The subsystems of this equipment are commonly available from manufacturers of optical and electronic equipment. The other components are easily purchased, or

fabricated. The scanner discussed is the Model DS-1260 digital line scanner manufactured by Daedalus Enterprises, Inc. It is a dual-sensor system which is operated in one of two combination of sensors: one spectrometer head (which provides simultaneous coverage in ten visible channels) and one thermal infrared detector, or simply two thermal infrared detectors.

33698 **(LA—8720) Picosecond high-power switching at the Los Alamos National Laboratory.** Knox, W. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 9p. NTIS, PC A02/MF A01. Order Number DE81030421.

A technique developed at the University of Rochester's Laboratory for Laser Energetics for generating high-power megawatt electrical pulses of picosecond risetime has been applied successfully to a streak camera system in the Los Alamos National Laboratory Physics Division Group P-3. The performance of the camera has been improved greatly through increased sweep speed, reduced optical-trigger energy, extended retracing times, and greatly reduced jitter. In addition, preliminary results were obtained in an experiment to generate multikilovolt electrical pulses synchronous with a nanosecond $CO_2$ laser pulse. These pulses could be used to drive streak cameras or Pockels cells or to trigger other diagnostics.

33699 (LBL—12000, pp 3-138) **Metallurgy and ceramics.** Gronsky, R.; Thomas, G. Jun 1981. NTIS, PC A24/MF A01. Order Number DE81027828.

In Materials and Molecular Research Division annual report 1980.

Atomic resolution microscopy is to study the structure and properties of materials directly at the atomic level by electronoptical imaging of individual atoms. To this end, a set of design specifications was issued by LBL earlier this year for the Atomic Resolution Microscope (ARM), an instrument that will be capable of resolving atomic positions in close-packed structures with the further provision for variable voltage operation so as not to exclude imaging of radiation-sensitive materials. On July 24, 1980 the contract for the ARM was awarded to JEOL, USA, Inc., with shipment expected during August of 1982. When installed near MMRD Building 72, this instrument will become a shareable resource in LBL's National Facility for Electron Microscopy. The first of the feeder instruments associated with the ARM, a JEM 200 CX, was installed in December 1980. Initial resolution tests have been highly successful and this instrument is currently being calibrated for high resolution operation to initiate the research programs in atomic resolution microscopy.

33700 **(SAND—80-2689) Transient temperature response of strain gages.** Adams, P.H. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 17p. NTIS, PC A02/MF A01. Order Number DE81031922.

The use of electrical resistance strain gages for the measurements of strain under transient temperature conditions presents the problem of determining the thermal output or apparent strain of the strain gage with sufficient accuracy to achieve satisfactory results. Various circuit temperature compensation techniques have been used by other investigators in the past, but little data are available relative to the accuracy of those techniques under transient temperature conditions. In particular, published data has been limited to temperature changes not exceeding 30° F per second. In preparation for a specific measurement problem, the thermal response of one model of AilTech high temperature weldable strain gage was determined for a temperature rise rate of 100° F per second.

33701 **(SAND—81-1782) Microcomputer-controlled communication network for Sandia National Laboratories' environmental test chambers.** Bennett, L.C. (Sandia National Labs., Livermore, CA (USA)). Aug 1981. Contract AC04-76DP00789. 15p. NTIS, PC A02/MF A01. Order Number DE81030988.

A microcomputer-controlled communication system that links together in a network four data-acquisition computers and four low-level signal scanner/amplifiers is described. The scanner/amplifiers monitor transducers that are connected to specimens within environmental test chambers located in the high-bay area of Sandia's Building 860. General topics addressed are the microcomputer hardware and its controlling program.

33702 **(UCRL—85763-Rev.1) Computer modeling of piezoresistive gauges.** Nutt, G.L.; Hallquist, J.O. (Lawrence Livermore National Lab., CA (USA)). 7 Aug 1981. Contract W-7405-ENG-48. 12p. (CONF-810931—2(Rev.1)). NTIS, PC A02/MF A01. Order Number DE81029610.

From 1. symposium on gages and piezoresistive materials; Archon, France (29 Sep 1981).

A computer model of a piezoresistive gauge subject to shock loading is developed. The time-dependent two-dimensional response of the gauge is calculated. The stress and strain components of the gauge are determined assuming elastic-plastic material properties. The model is compared with experiment for four cases. An ytterbium foil gauge in a PPMA medium subjected to a 5.0 kbar plane shock wave, where the gauge is presented to the shock with its flat surface both parallel and perpendicular to the front. A similar comparison is made for a manganin foil subjected to a 27.5 kbar shock. The signals are compared also with a calibration equation derived with the gauge and medium properties accounted for but with the assumption that the gauge is in stress equilibrium with the shock medium.

33703 **Stabilized aerosol generator.** DeFord, H.S.; Clark, M.L.; Moss, O.R. (Pacific Northwest Lab., Richland, WA). Contract DE-AC06-76RL01830. *American Industrial Hygiene Association Journal ;* **42**: No. 8, 602-604(Aug 1981).

Pneumatic nebulizers are commonly used to aerosolize solutions, but are not a stable source of aerosols. Evaporative solvent losses concentrate the solution causing a corresponding increase in nebulizer output. The addition of a simple double reservoir system will stabilize the output of a commercially available pneumatic nebulizer by isolating the effects of solvent evaporation to a small transient portion of the solution.

33704 **Collection efficiencies of a point-to-plane electrostatic precipitator.** Cheng, Y.S.; Yeh, H.C.; Kanapilly, G.M. (Inhalation Toxicology Research Inst., Albuquerque, NM). Contract AC04-76EV01013. *American Industrial Hygiene Association Journal ;* **42**: No. 8, 605-610(Aug 1981).

Collection efficiencies of a point-to-plane electrostatic precipitator were evaluated as functions of particle size, aerosol flow and ion current. Monodisperse aerosols ranging from 0.03 to 2.0 μm were used. Collection efficiencies decrease with 1) an increase of aerosol flow rate, 2) a decrease of particle size and 3) an increase of ion current. Average efficiencies were found to be 90, 85 and 85% over the entire particle size range used in this study, for ion currents of 1.0, 3.5 and 5.0 microamperes respectively.

33705 **Optical device with conical input and output prism faces.** Brunsden, B.S. (to to Department of Energy). US Patent 4,255,021. 10 Mar 1981. Filed date 20 Apr 1979. vp.

A device for radially translating radiation in which a right circular cylinder is provided at each end thereof with conical prism faces. The faces are oppositely extending and the device may be severed in the middle and separated to allow access to the central part of the beam. Radiation entering the input end of the device is radially translated such that radiation entering the input end at the perimeter is concentrated toward the output central axis and radiation at the input central axis is dispersed toward the output perimeter. Devices are disclosed for compressing beam energy to enhance drilling techniques, for beam manipulation of optical spatial frequencies in the fourier plane and for simplification of dark field and color contrast microscopy. Both refracting and reflecting devices are disclosed.

33706 **Fabricating thin beryllium windows for X-ray applications.** Truhan, J.J.; Wagner, L.M. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Instruments and Methods ;* **176**: No. 3, 481-485(15 Oct 1980).

X-ray windows for diagnostics into vacuum chambers are commonly made of beryllium, which must be as thin as possible to minimize attenuation of the X rays. The windows must be bonded

to mounting flanges, and the bond must be leak-tight and able to withstand a pressure differential of one atmosphere. A solid-state bonding process can be used to attach windows of thickness from 0.025 down to 0.015 mm. The process bonds the beryllium window, a silver intermediate layer, and the mounting flange together using compression and heat. The process is not sensitive to the bonding parameters; usual ranges are: pressures of 83-172 MPa, temperatures of 750-950 K, and holding times of 5-60 min. Unsuccessful bonds can often be repaired or parts can be salvaged for re-use. A variety of window geometries can be accommodated.

### 4404 Well Logging Instrumentation

*REFER ALSO TO CITATION(S) 32900, 32961*

33707 **Magnetic resonance apparatus.** Jackson, J.A.; Cooper, R.K. US Patent Application 195,968. 10 Oct 1980. 17p.

The patent consists of means for producing a region of homogeneous magnetic field remote from the source of the field, wherein two equal field sources are arranged axially so their fields oppose, producing a region near the plane perpendicular to the axis midway between the sources where the radial correspondent of the field goes through a maximum. Near the maximum, the field is homogeneous over prescribed regions.

## 45 EXPLOSIONS AND EXPLOSIVES

### 4501 Chemical

33708 **(LA—8930-MS) Computer modeling of an all-secondary explosive hot-wire device.** Varley, D.T. III. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 28p. NTIS, PC A03/MF A01. Order Number DE81030438.

A computer model of an all-secondary explosive hot-wire device is described. The model accounts for the ignition of the explosive by electrical heating of a wire and the shearing of a flying plate that is subsequently used to detonate a second explosive. The results obtained from the model are in excellent agreement with experimental data.

33709 **(LA-UR—81-1835) Global kinetics for the shock-induced decomposition of heterogeneous explosives.** Wackerle, J.; Anderson, A.B. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 13p. (CONF-811014—3). NTIS, PC A02/MF A01. Order Number DE81025252.

From 11. North American Thermal Analysis Society conference; New Orleans, LA, USA (19 Oct 1981).

Methods were developed to determine empirical rate laws for the shock-induced decomposition of condensed explosives. Pressure-field histories are measured with embedded gauges in plane-wave shock-initiation experiments. A Lagrangian analysis is used to integrate the fluid-dynamic conservation relations, giving the histories of density and energy fields in the reactive flow. A reactant-product equation of state is assumed and a global reaction progress variable and the associated reaction rate are calculated. Correlations of the rate to other state variables provide empirical rate laws, which prove successful in the numerical modeling of numerous initiation and detonation phenomena. Heterogeneous explosive rate laws combining three factors - shock-strength, depletion, and heating - are consistent with many shock-initiation observations and the favored nucleation and growth concept of shock-induced decomposition. The strong correlation to a simple Arrhenius heating factor is remarkable, because the temperature is an average, equilibrium quantity calculated from the equation of state, yet the formation of local high-temperature regions, or hotspots, is the dominant reaction mechanism in heterogeneous explosives. Possible physical implication of the Arrhenius correlation, and other choices for the three rate factors are discussed.

33710 **(LA-UR—81-2482) Reaction rates from pressure-gauge measurements in reacting explosives.** Ginsberg, M.J.; Anderson, A.B.; Wackerle, J. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 15p. (CONF-810931—3). NTIS, PC A02/MF A01. Order Number DE81030252.

From 1. symposium on gages and piezoresistive materials; Archon, France (29 Sep 1981).

The proper hydrodynamic data and an equation of state are sufficient to describe quantitatively the reaction rates of explosives during the shock-to-detonation transition. Manganin pressure gauges embedded in the reacting explosive have provided these data for the explosives PETN, PBX 9404, TATB, and TNT. Once a pressure-field history has been assembled from individual pressure histories at different depths in the explosive, the conservation equations can be applied in a Lagrangian analysis of the data. The combination of a reactant-product equation of state with this analysis then allows the calculation of the extent of reaction and reaction rate. Successful correlation of the calculated reaction rate values with other thermodynamic variables, such as pressure or temperature, allows formulation of a rate law and the prediction of initiation behavior under circumstances quite different from the experiments that led to the rate law. The best dynamic piezoresistive pressure gauge for most applications would have a substantial output voltage and present negligible disturbance to the flow. In explosives, however, requirements for survival in the extreme temperature and pressure environment encountered by the gauge dictate compromise. Low electrical resistance ($\sim$ 20 m$\Omega$) helps to minimize shunt conductivity failures, but this drastically reduces output and demands that much attention be given to reducingnoise. Although relatively thick insulation perturbs the flow to some extent, survivability requirements dictate its use. Pressure measurements in reactive flow can now be made routinely with gauges that successfully produce data leading to a description of the flow and a powerful predictive capability.

33711 **(MHSMP—81-37) Proton and carbon-13 NMR study of stockpile-aged LX-09.** Clink, G.L. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Sep 1981. Contract AC04-76DP00487. 14p. NTIS, PC A02/MF A01. Order Number DE81030482.

$^{1}H$ and $^{13}C$ nuclear magnetic resonance analysis of stockpile aged LX-09 shows the retention of molecular integrity of the admixture components. A moderately small increase in the FEFO and p-DNPA concentrations is found in the outer perimeter area of the LX-09 main charge piece, accompanied by a slight decrease in the concentration of these components in the center and inner perimeter areas.

33712 **(MHSMP—81-38) Holston-Pantex LX-17 formulation comparison.** Neff, G.W. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Sep 1981. Contract AC04-76DP00487. 32p. NTIS, PC A03/MF A01. Order Number DE81030481.

A comparison was made between a 1270 kg LX-17 lot formulated at Holston and smaller LX-17 lots formulated at Pantex. Chemical, thermal, mechanical sensitivity and physical property analyses were compared. The Holston LX-17 lot pressed to a slightly higher density, had less growth, and gave a higher strain level. Otherwise, there were no significant differences found between the Holston and Pantex-formulated material.

33713 **(SAND—81-0937) Deflagration-to-detonation transition (DDT) project. Semiannual report, June-November 1980.** Perkins, W.G. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Jul 1981. Contract AC04-76DP00789. 40p. NTIS, PC A03/MF A01. Order Number DE81030979.

Studies of the Deflagration-to-Detonation Transition (DDT) distance in detonators, performed during June through November 1980, are reported in detail. Accomplishments include development of small, safe detonators and of computer models of DDT, and development of methods to analyze impurities in CP.

33714 **(UCRL—52903) Detonation-product behavior at large expansion: the underwater detonation of nitromethane.** Helm, F.H. Jr.; Chambers, E.S.; Lee, E.; Finger, M.; McGuire, R.R.; Mahler, J.P.; Cheung, H.; Cramer, J.L. (Lawrence Livermore National Lab., CA (USA)). Dec 1980. Contract W-7405-ENG-48. 29p. NTIS, PC A03/MF A01. Order Number DE81030468.

The expanding product gases of the explosive used in rock fracturing, cratering, and air or underwater explosions do work on the surroundings even at relatively low pressures. To characterize explosives for these applications it is necessary to obtain an almost complete expansion history. An underwater test which was used to measure the shock-wave travel and gas bubble resulting from the detonation of 2 kg of nitromethane is described. The bubble expansion was photographically measured to a volume of about 80 times the initial volume of the shell. These experimental measurements compared well with those calculated by a one-dimensional hydrodynamic program, KOELAS. KOELAS also provided data to assist in the calculation of the apparent position of the shell containing the explosive, using refractive index gradients and the bubble position as a function of time. A method for estimating optical ray paths penetrating the expanding shock front and a modification to a streaking camera that permits stable operation at low rotor speeds are described. The expansion exhibited a minimum pressure of 2 MPa (20 bars), an amount in the range of rock blasting applications, underwater explosions, and rock fracturing or cratering.

33715 **(UCRL—86372) Free-surface velocity measurements of plates driven by reacting and detonating RX-03-BB and PBX-0404.** Erickson, L.M.; Palmer, H.G.; Parker, N.L.; Vantine, H.C. (Lawrence Livermore National Lab., CA (USA)). 13 Jul 1981. Contract W-7405-ENG-48. 6p. (CONF-810684—50). NTIS, PC A02/MF A01. Order Number DE81026776.

From APS conference on shock waves in condensed matter; Menlo Park, CA, USA (23 Jun 1981).

Copper plates 90 mm in diameter, of thickness 0.25 mm and 0.5 mm, were accelerated by an adjacent 17 mm thick cylinder of RX-03-BB or PBX-9404-03. The explosive was initiated by impact of a thick flyer from the LLNL 102 mm gun, providing either a reactive or fully detonating wave, by appropriate choice of flyer velocities up to 1.30 mm/μs. The free surface velocity of the plates were measured with a Fabry-Perot velocimeter. Excellent experimental free-surface velocity histories have been obtained. Calculations of this history employing beta-burn and nucleation and growth high explosives models are in good agreement with fully detonating experiments. For reacting RX-03-BB, adjustments in the parameter are needed. The experimental technique gives records whose agreement with calculation is sensitive to the model and is therefore a good way of testing new high explosive models. Also, this method allows one to infer information about the reaction zone length.

33716 **(UCRL—86563) High-explosive detonations in varying-oxygen atmospheres.** Kovar, F.R.; Trigger, K.R.; Guymon, L.G.; Harvey, J.R. (Lawrence Livermore National Lab., CA (USA)). 13 Aug 1981. Contract W-7405-ENG-48. 6p. (CONF-810684—48). NTIS, PC A02/MF A01. Order Number DE81028179.

From APS conference on shock waves in condensed matter; Menlo Park, CA, USA (23 Jun 1981).

Small spheres of PBX9404 AND TNT were detonated in atmospheres of varying oxygen content to study the magnitude of the effects of oxygen on afterburn of high explosive (HE) detonation products (DPs). Each of the fireballs (FBs) formed by the HEDPs was observed by high-speed cameras and radiometers in the visible and near infrared. It was found that afterburn dominates the FB radiation, while having much less influence on FB size than do instabilities and turbulence. One-dimensional nonreactive fluid flow calculations of the FB radius-time (R-T) history and shock characteristics within the FB were performed. The R-T results are in good agreement with the experment at early times, while the internal shock agreement extends over a much longer period.

## 4502 Nuclear

33717 **(FEMA—2563F) Blast/fire interactions. Proceedings of conference held in Asilomar, California, May 18-21, 1980.** Alger, R.S.; Martin, S.B. (eds.). (SRI International, Menlo Park, CA (USA)). Feb 1981. 235p. Federal Emergency Management Agency, Washington, DC. Order Number DE81904002.

This report summarizes the proceedings of the FEMA-sponsored conference on blast/fire-interaction research held May 18-21, 1980, at Asilomar, California. This conference, the third of an annual series, convened a selected group of authorities on fire effects, airblast effects, structural responses, and related technologies to reassess the significance of this nuclear-attack problem area and evaluate the contributions that ongoing studies are making, and proposed research could add, to alleviate the technical deficiencies which limit analytical progress. A continuing research program to upgrade the state of art at a rate consistent with national priorities and the perceived urgency for increased national security is described and recommended. Contingent funding levels are provided to aid FEMA planning.

33718 **(LA-tr—81-23) Improvements in explosive charges.** (Los Alamos National Lab., NM (USA)). 1981. Translation of . French Patent 971,324. 12p. NTIS, PC A02/MF A01. Order Number DE81028977.

The perfection of explosive charges made up chiefly of uranium and thorium is liable to cause, because of neutron activity, a chain reaction. Improvements are described that consist of determining the mass or critical conditions, of assembling the explosive charge so that at the desired time the critical conditions are attained or surpassed and, at the instant of the explosive charge's use, to achieve those conditions equal or superior to the critical conditions, whether gradually or all at once, and in any case, preferably at extreme speed at the end of the process.

33719 **(UCID—19164) Engineering evaluation of Riola containment.** Casamajor, A.B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Aug 1981. Contract W-7405-ENG-48. 23p. NTIS, PC A02/MF A01. Order Number DE81030478.

An independent review of the engineering of the Riola Event (U2eq) containment system was conducted. This review included interviews with personnel involved with the event's containment, and examination of available documentation at Lawrence Livermore National Laboratory and at the Nevada Test Site. Calculations were made to verify the adequacy of the lower coal tar epoxy plug design. All activities associated with the containment system design and installation were found to conform with established specifications and procedures. Recommendations are made regarding the need for additional engineering data on containment systems, and on the need for more complete documentation of containment system requirements.

## 4503 Explosion Detection

33720 **(UCRL—53103) Calculations on seismic coupling of underground explosions in salt.** Heusinkveld, M.E. (Lawrence Livermore National Lab., CA (USA)). 20 Jan 1981. Contract W-7405-ENG-48. 117p. NTIS, PC A06/MF A01. Order Number DE81030633.

This report details the results of a theoretical study of seismic coupling and decoupling of underground explosions in a salt medium. A series of chemical and nuclear explosions was carried out years ago in salt domes for the Cowboy and the Dribble programs to provide experimental data on seismic coupling for both tamped explosions and explosions in cavities. The Cowboy program consisted of a series of chemical explosions, and the Dribble program consisted of the tamped nuclear Salmon event, the Sterling nuclear event in the Salmon cavity, and an associated site calibration effort. This report presents the results of extensive computer calculations, which are in satisfactory agreement with the experimental data. The calculations were extended to give general results on seismic coupling in salt. The measure of seismic coupling for most of this work was the residual reduced displacement potential

(residual RDP). The decoupling associated with a shot in a cavity was expressed as the ratio of the resulting residual RDP to that of an equal-sized tamped shot.

# 50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

## 5001 Basic Studies

*REFER ALSO TO CITATION(S) 33748, 33749, 33750, 33751, 33752, 33754*

33721 **(DOE/EV/10539—T1) Climatological relationships between monthly mean surface temperature and mid-tropospheric heights. Progress report, November 1, 1980-June 30, 1981.** Klein, W.H. (Maryland Univ., College Park (USA). Dept. of Meteorology). 1981. Contract AS05-81EV10539. 36p. NTIS, PC A03/MF A01. Order Number DE81029841.

Progress made during the first eight months of research designed to improve the accuracy of monthly mean temperature forecasts in the contiguous United States is reported. Studies include research to rederive the statistical equations now used to specify mean temperature anomalies from mean height anomalies. The decision was made to compute all future correlation fields from anomalies, rather than absolute values of temperature and height. The screening process being used in the investigation is described.

33722 (ORNL/TM—7744, pp 5-42) **Studies at Plant Bowen: rainfall modification and wetfall chemistry.** Patrinos, A.A.N.; Miller, R.L.; Saylor, R.E. (Oak Ridge National Lab., TN). Sep 1981. NTIS, PC A05/MF A01. Order Number DE81030431.

In Meteorological Effects of Thermal Energy Releases (METER) program. Annual progress report, October 1979-September 1980.

The study of inadvertent rainfall modification due to the waste heat and moisture discharged by the cooling towers at the Bowen Electric Generating Plant (Georgia Power Company) continued. During this period, substantial data were obtained from the network of recording raingages and windsets; analysis of this data for the first 18 months of the study was completed. The results indicate the presence of an effect considerably more subtle than a mere increase or decrease of rainfall volume in the affected area, possibly an increase in rainfall pattern variability. The tentative conclusion of only a marginal effect on rainfall is tempered by the observation that heat dissipation from the cooling towers exceeded 1800 MW-electrical for only 50% of the storms. Cooling tower/stack interaction was investigated at Plant Bowen through a wetfall chemistry study involving all METER participants. Results from the ORNL activities (rainfall magnitude, distribution, and chemistry) on this Winter Study of Power Plant Effects (WISPE) were limited, since only one significant precipitation event occurred during the test period (December 1979). The data showed no discernible patterns in deposition rates (ion concentration times rainfall rate) for hydrogen and ammonium ions but a definite pattern, suggesting a plume washout effect, for sulfate and nitrate ions.

33723 (ORNL/TM—7744, pp 49-79) **Anomalous snowfall caused by natural-draft cooling towers.** Koenig, L.R. (Rand Corp., Santa Monica, CA). Sep 1981. NTIS, PC A05/MF A01. Order Number DE81030431.

In Meteorological Effects of Thermal Energy Releases (METER) program. Annual progress report, October 1979-September 1980.

Field observations and numerical simulation are used to define circumstances under which plumes from large natural-draft cooling towers should be expected to glaciate and cause snowfall. The joint condition of temperature colder than -13°C and saturation deficit less than 0.5 g $m^{-3}$ was found to be the primary prerequisite for snowfall. If the plume merges with a cloud layer, the flux of snow may exceed the water vapor flux from the cooling tower.

## 5002 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 32879, 32944, 32989, 33271, 33445, 33574, 33579, 33580, 33590, 33770, 33784, 33787, 33790, 33801, 33854, 33885, 33908, 33910, 33952*

33724 **(ATDL—81/5) Handbook on atmospheric diffusion models.** Hanna, S.R. (National Oceanic and Atmospheric Administration, Oak Ridge, TN (USA). Atmospheric Turbulence and Diffusion Lab.). 5 Mar 1981. 72p. NTIS, PC A04/MF A01. Order Number DE81030474.

In this handbook, atmospheric diffusion models that are widely used for regulatory purposes are reviewed. It is found that the Gaussian plume model is most often used in western countries, while the gradient-transport (K) model is most often used in eastern countries. The most important parameters predicted by the models are the magnitude and location of maximum ground level concentrations. The models are compared theoretically and empirically using observations, with the conclusion that maximum concentrations predicted by the two models can differ by an order of magnitude, with the sign of the difference depending on the specific application. On the average, the models agree fairly well. The largest scientific difference is in the plume rise formulas, where the USA model predicts plume rises for typical industrial stacks that are an order of magnitude higher than those predicted by the USSR model. Recent developments in model applications to complex terrain, long range transport, and area sources are also reviewed. There is much current interest in developing model performance measures and standards. A few research-grade models are discussed, to illustrate the types of models that can be expected to appear in regulatory procedures in the future. These models are not now in wide-spread use, because they have not been adequately tested or have problems with excessive use of computer time.

33725 **(BNL—51378) MAP3S/RAINE emissions inventory. Progress report, December 1980.** Benkovitz, C.M. (Brookhaven National Lab., Upton, NY (USA)). 1980. Contract AC02-76CH00016. 53p. NTIS, PC A04/MF A01. Order Number DE81030225.

The goal of phase I of the Multistate Atmospheric Power Production Pollution Study (MAP3S) program was to develop and demonstrate an improved, verified capability of numerically simulating the present conditions and potential changes in pollutant concentration, atmospheric behavior and precipitation chemistry that result, or will result, from pollutants released to the atmosphere by large-scale power production processes. The program was divided into ten major tasks. Tasks 1 and 2 of the MAP3S Program Plan were concerned with the quantification of emissions of pollutants from power production and nonpower production sources. These tasks have been continued under MAP3S/RAINE (Regional Acidity of Industrial Emissions). The emissions inventory project has been based on obtaining pertinent data gathered by other agencies (EPA, FPC, state and local governments, etc.), and computerizing, correlating, and updating such data. This report describes the development of the project to date. Topics covered include the acquisition of both emissions and ancillary data, techniques developed for quality assurance and data updating, summaries of the data in the inventory and descriptions of current and future plans in both upgrading and using the inventory.

33726 (CONF-800433—, pp 61-81) **Resolving the sources of airborne particles for the regional air pollution studies.** Alpert, D.J.; Hopke, P.K. (Univ. of Illinois, Urbana). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Target transformation factor analysis (TTFA) has been applied to an analysis of a subset of the aerosol-composition data acquired during the Regional Air Pollution Study (RAPS) for St. Louis, MO. The RAPS program collected a large number of samples with ten, continuously operated, dichotomous samplers from March 1975 to March 1977. The purpose of the present study was to evaluate the capability of TTFA to resolve sources of airborne particulate matter in a set of ambient-aerosol samples. Only the samples from one sampling station, for July and August 1976, both

fine and coarse fractions, were examined in this study. Because of the large number of missing values and values below the detection limits, it was necessary to exclude a sizable fraction of the data from the analyses. Separate analyses were performed on the samples from the fine and coarse fractions. In the fine-fraction data, secondary sulfate aerosol particles accounted for 64% of the mass of the average sample. Motor vehicle emissions accounted for another 15%. In the coarse fraction, soil and limestone particles accounted for 80% of the average sample mass.

33727 (CONF-800433—, pp 82-95) **Identifying locations of dominant point sources of elements in urban atmospheres from large, multielement data sets.** Rheingrover, S.W.; Gordon, G.E. (Univ. of Maryland, College Park). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Because of the inaccuracies of source-emissions inventories and dispersion models, air pollution control authorities are beginning to use receptor models to determine contributions of various sources to total suspended particulate matter in urban areas. A major limitation of receptor models is the poor quality of existing data on compositions and size distributions of particles from the important types of sources in some urban areas. A new method for determining compositions for particles from sources is proposed. Samples heavily impacted by certain sources are identified by searching large data sets for samples with unusually high concentrations of certain elements that were obtained during periods of small wind fluctuation. The mean wind directions for these groups of samples often form clusters about angles pointing to major sources of the elements. By triangulation of wind trajectories from several sampling stations, one can pinpoint the source of the element to within a 1.5- x 1.5-km area in favorable cases. Samples heavily influenced by a source can be analyzed in detail to obtain the composition of particles from the source in question.

33728 (CONF-800433—, pp 96-105) **Nuclear activation analysis methods and the evaluation of volcanic deposits and emissions.** Zoller, W.H. (Univ. of Maryland, College Park); Anderson, D.L.; Failey, M.P.; Germani, M.S.; Moyers, J.L.; Mosher, B.W. 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Samples of volcanic deposits from the top of Mt. Erebus, an active volcano on the coast of Antarctica, were collected for chemical analysis. Filters were used to collect particles in the plume of the volcano for comparison with the deposits. Vapor-phase forms of the halogens and arsenic were collected using charcoal traps and treated filters. Analyses were performed using prompt $\gamma$-ray activation analysis (PGAA) and instrumental neutron activation analysis (INAA) for approximately 40 elements. Non-destructive nuclear analytical techniques make it possible to determine chemical compositions of valuable samples without modification. Analyses of the plume samples showed that large fractions of the halogens were in the gas phase and rather large quantities of Cl and As are being emitted by the volcano. The deposits found in the vicinity of the plume on the summit of the volcano were variable, but were, in general, water soluble and contained large abundances of F and Cl, as well as Na, Al, Si and Fe. Using x-ray diffraction, we identified several previously unknown minerals all of which are relatively water soluble and unique to volcanoes. Most of the volatile trace metals, such as Sb, Cd, Zn and In, are highly enriched in the plume and in deposits relative to their abundances in the magma. Since this volcano has a permanent lava lake, it is postulated that the volatile elements leave the magma in a molecular form which has a high vapor pressure at the temperatures of the melt.

33729 (CONF-800433—, pp 175-180) **Atmospheric deposition of heavy metals studied by analysis of moss samples using neutron activation analysis and atomic absorption spectrometry.** Rambaek, J.P. (Inst. for Energy Tech., Kjeller, Norway); Steinnes, E. 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

In a study of the atmospheric deposition of trace elements in different parts of Norway samples of the moss Hylocomium splendens were analyzed with respect to 26 elements. The determination of Cu, Zn, Pb, Cd and Ni was carried out by flame atomic absorption spectrometry, while an additional 21 elements were determined by instrumental neutron activation analysis. Several elements showed a substantially higher deposition in the southernmost parts of Norway than in places located farther north. As regards Pb, As and Sb, the difference amounted to a factor of ten or more. A similar but less pronounced trend was evident for elements such as V, Zn, Cd, Se and Ag. In some cases local pollution sources or marine aerosols had a significant effect on the results. For several heavy metals however long-distance transport from areas to the south and the south west of Norway was responsible for a major part of the air pollution.

33730 (CONF-800433—, pp 195-204) **Activation-analysis prospects by using a concentric 5 x $10^{12}$ N/S sealed neutron tube combined with a fast rabbit system.** Fanger, H.U.; Pepelnik, R.; Michaelis, W. (Inst. fuer Physik, GKSS-Forschungszentrum, Geesthacht, Germany). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

A new type of intense 14 MeV neutron generator with cylindrical acceleration structure is being installed at the GKSS Research Center Geesthacht. The system represents a modification of a sealed neutron tube originally designed for medical therapy. In combination with a fast pneumatic rabbit system which transports samples within 140 ms to a remote detector station at 16 m distance, the facility has particular capabilities for neutron activation analysis and cross section studies involving short-lived reaction products. The averaged neutron flux available for activation is 5.5 x $10^{10}$ n/cm$^2$ s with inhomogeneities of less than 7% within sample volumes of about 3 cm$^3$. Detailed calculations reveal that half the ensemble of 78 elements can be detected below a 1 $\mu$g level. Thus, the new facility might also provide favourable conditions for applications in environmental studies like surveillance of air pollution or water quality.

33731 (CONF-800433—, pp 205-215) **Neutron activation analysis without multi-element standards.** Ahmad, A. (Univ. of London Reactor Center, Berkshire, England); Mac Mahon, T.D.; Macwani, M.; Minski, M.J.; Williams, J.G.; Bereznai, T. 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The extra information which is required to carry out neutron activation analysis without the use of multi-element standards is discussed. Particular emphasis is placed on the characterization of the neutron flux in the irradiation, and a rationalized self-consistent flux convention is described in some detail.

33732 (CONF-800433—, pp 231-246) **Environmental trace element analysis using short-lived nuclides.** Chatt, A.; DeSilva, K.N. (Dalhousie Univ., Halifax, Nova Scotia). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Pseudo-cyclic, cyclic thermal, and cyclic epithermal instrumental neutron activation analysis methods have been developed for the simultaneous determination of multielement concentrations through short- and medium-lived nuclides. The methods have been successfully applied to a number of environmental and biological sample matrices. Precision, accuracy, and limits of detection of these methods have been observed to be superior to conventional INAA methods. Various aspects of the methods are described here.

33733 (CONF-800433—, pp 296-305) **NAA as viewed from the perspective of International Atomic Energy Agency intercomparison tests.** Dybczynski, R. (IAEA, Vienna, Austria). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Results of several IAEA intercomparison runs organized over the last 8 years are analyzed from the point of view of contribution and performance of NAA as compared to other techniques. It is shown that NAA is the method of good accuracy and precision providing on average greater share of results than any other single analytical technique. The prominent position of NAA among other methods used in trace analyses seems to be firmly established and there are no signs that there might be any change of the trend in the nearest future.

33734 (CONF-800433—, pp 306-312) **PIXE analysis of biological and environmental samples using a proton microprobe.** Wilde, H.R.; Bischof, W.; Raith, B.; Gonsior, B. (Ruhr-Univ., Bochum, Germany). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

For the investigation of environmental and biological samples a proton microprobe has been built up at the Bochum Dynamitron Tandem Laboratory. By means of PIXE this device is used to measure lateral distributions of a wide range of trace elements in thin samples. Application of this technique to problems in the biological microstructure is of considerable interest, since presence or absence of certain elements at well defined places affects biological properties strongly.

33735 (CONF-800433—, pp 337-352) **Activation analysis with short lived nuclides in environmental research.** Grass, F. (Atominstitute, Vienna, Austria). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

With the aid of our fast pneumatic tube system activation analysis with short lived nuclides gives prompt information on certain elements. For this purpose a fast pulse processing system developed in our Institute renders it possible to measure radionuclides down to a half life of 20 ms. By means of successive prolonged measurements, the full information of the single irradiation is available. And immediately following longer irradiation with appropriate decay time and successive prolonged measurements delivers activities up to a half life of hours. Cyclic activation with progressive prolonged irradiations and pulse activation may be used to enlarge the sensitivity range. On-line evaluation enables very rapid analysis. This is demonstrated by examples, e.g., activation analysis of lead in an automobile exhaust by the 0.8s Pb-207m, of short lived nuclides in fly ash, in dust samples and in testing filter systems. Boron in fly ash may be determined by the 20ms B-12.

33736 (CONF-800433—, pp 437-441) **Neutron activation analysis of copper and silver in environmental samples.** Shah, P.K.; Haldar, B.C. (Inst. of Science, Bombay, India). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

A rapid method is described for simultaneous determination of copper and silver in environmental samples by thermal neutron activation analysis involving substoichiometric extraction with HINAP. The time required for radiochemical purification and counting of two samples and one standard does not exceed 2 hours. 1 μg of copper and 0.021 μg of silver could be determined with an accuracy of 11 and 15%, respectively.

33737 (CONF-800433—, pp 671-684) **Substoichiometric isotope dilution analysis of tin in coal fly ash.** Suzuki, N.; Imura, H. (Tohoku Univ., Sendai, Japan). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

An accurate and precise analytical method for traces of tin by substoichiometric isotope dilution has been investigated. The present method consists of the extraction of tin(IV) as iodide into benzene, the complex formation of tin(IV) with the substoichiometric amount of salicylideneamino-2-thiophenol in the benzene phase. The reproducibility of the substoichiometric separation is satisfactorily good, and the determination of tin in microgram order can be expected. The high selectivity of this method has been ascertained by adding 17 foreign metals and 11 radioactive tracers to the tin(IV) solution. The present method has been applied to the determination of tin in environmental materials, NBS Coal Fly Ash (SRM 1633) and fly ash from coal-fired power plant in Japan.

33738 **(CONF-801259—) Workshop on indoor air quality research needs.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC; Environmental Protection Agency, Washington, DC (USA). Office of Environmental Engineering and Technology). 1980. 350p. (EPA—600/7-81-118). NTIS, PC A15/MF A01. Order Number DE81026488.

From Workshop on indoor air quality research needs; Leesburg, VA, USA (3 Dec 1980).

Workshop participants report on indoor air quality research needs including the monitoring of indoor air quality, report of the instrumentation subgroup of indoor air quality, health effects, and the report of the control technology session. Risk analysis studies addressing indoor environments were also summarized. (DLS)

33739 (CONF-801259—, pp 23-38) **Monitoring indoor air quality.** 1980. NTIS, PC A15/MF A01. Order Number DE81026488.

From Workshop on indoor air quality research needs; Leesburg, VA, USA (3 Dec 1980).

Introductions and discussions of measuring methods and research needs on the subject of indoor air pollution are studied. The monitoring section organization consists of aerosols, organics, criteria gases, radon, formaldehyde, and a section on statistics and modelling methods. (DLS)

33740 (CONF-801259—, pp 39-96) **Report of the instrumentation subgroup of indoor air quality.** 1980. NTIS, PC A15/MF A01. Order Number DE81026488.

From Workshop on indoor air quality research needs; Leesburg, VA, USA (3 Dec 1980).

Seven sections describe an initial attempt to formulate a research strategy plan to begin the development of a comprehensive program for developing sampling and analytical methods for hazardous chemical and physical agents which people are exposed to in enclosed structures like residences, offices, and public buildings. The plan calls for the development of instrument requirements, quality assurance programs for analytical laboratories, new and intelligent portable instruments, and Government regulations or guidelines so that instrument manufacturers recognize a market.

33741 (CONF-801259—, pp 137-174) **Report of the control technology session of the workshop on indoor air quality research needs.** 1980. NTIS, PC A15/MF A01. Order Number DE81026488.

From Workshop on indoor air quality research needs; Leesburg, VA, USA (3 Dec 1980).

Findings and recommendations of a control technology group are summarized as planning of indoor air quality research needs were briefly reviewed. Problems discussed included pollutant identification, source identification, emission rates and mechanisms, description of transport mechanisms, health risks, and development of evaluation methods. (DLS)

33742 **(DOE/FC/10193—T1) Survey of particulate emission macro- and micro-sampling and sizing methods and real-time monitoring and sizing methods.** Lipscomb, W.O. (Acurex Corp., Research Triangle Park, NC (USA)). Feb 1981. Contract AC18-80FC10193. 116p. NTIS, PC A06/MF A01. Order Number DE81028348.

A survey was conducted of recently developed methods for sampling and fractionating flue gas particulates. The survey was composed of three parts: (1) macro methods - sampling/fractionating equipment capable of collecting in each of several particle size cuts, macroscopic samples appropriate for subsequent chemical and

physical characterization, (2) micro methods - size-fractionated particulates for microanalysis and (3) real time-monitoring/sizing methods permitting real-time acquisition of particle size data via remote or point-of-measurement techniques. Results presented include a survey and cursory evaluation of commercially available macro, micro, and real time measurement systems. Also, research and development efforts underway in the commercial, academic, and governmental sectors were identified and delineated, where possible, with respect to primary researcher(s), affiliation, program objectives, schedule and sponsoring agency where applicalble. The study concludes that macro and micro methods utilizing impactors and cyclones are available, but reliable only with careful and proper operation. In contrast, real-time source monitoring of particle size is, with few exceptions, still in a developmental stage and very expensive.

33743 **(DOE/PC/30298—T3) Soot formation in synthetic fuel droplets. Third quarterly technical progress report, April 1 to June 30, 1981.** England, G.; Kramlich, J.; Kwan, Y.; Payne, R. (Energy and Environmental Research Corp., Santa Ana, CA (USA)). Jul 1981. Contract AC22-80PC30298. 36p. NTIS, PC A03/MF A01. Order Number DE81028391.

During the third quarterly period of the program, efforts have focused primarily on the generation of experimental data - previous periods having been concerned mainly with the design, construction, and commissioning of experimental hardware and diagnostic equipment. Supplies of SRC-II middle- and heavy-distillate fuel oils have been received, and the preliminary fuel screening studies in the 7 x $10^6$ Btu/h tunnel furnace have been extended to include also these fuels. A total of eight fuels (six synthetic and two petroleum-derived) have now been investigated; and soot, particulates, and NO/sub x/ emission levels have been obtained under comparable firing conditions for both normal and staged combustion, and at various overall excess air levels. Work has also continued on the Droplet Studies task where the combustion of single-droplet streams is investigated in a controlled flow reactor. Observations have shown that the SRC-II fuels exhibit a behavior different from conventional petroleum-derived fuels. The trajectory of every SRC-II fuel droplet was observed to terminate in a microexplosion. High-speed photography showed this to be an extremely rapid event resulting in the formation of a visible, luminous soot cloud. This behavior was not observed for a petroleum-derived No. 6 oil and appeared to be more pronounced for a blended SRC-II than for either the middle- or heavy-distillate fuels. Preliminary measurements have also been made of local soot concentrations and of the temperature of the soot sheet in the reactor system.

33744 **(EPRI-EA—270) Reactions of nitrogen oxides, ozone and sulfur in power plant plumes.** Hegg, D.A.; Hobbs, P.V.; Radke, L.F. (Washington Univ., Seattle (USA). Dept. of Atmospheric Sciences). Sep 1976. 139p. NTIS, PC A07/MF A01. Order Number DE82900004.

This report is concerned mainly with the results obtained on ozone in power plant plumes. Aerosol production in power plant plumes is discused only briefly. Thirty sets of airborne measurements have been obtained in the plumes from two coal-fired and two gas-fired power plants situated in different climatological areas. On no occasion was above ambient ozone found to be generated in a power plant plume out to distances at which the plume was still distinguishable from the ambient air. These field observations can be understood as follows. The precursors of ozone in fossil fuel power plants are nitrogen oxides, primarily nitric oxide. Nitric oxide must be converted to nitrogen dioxide in the plume before ozone can be produced. An analysis of the field data reveals that this conversion rate is generally controlled by the rate at which a plume mixes with the ambient air rather than by the relevant chemical reaction rates. Since this mixing rate is slower than the chemical reaction rates for the production of ozone, the conversion of nitric oxide to nitrogen dioxide (and hence to ozone) is slower than would be expected from laboratory or smog chamber experiments. The conversion rates are slow enough to make ozone production in power plant plumes unlikely. As far as the production of aerosol from gases in power plant plumes is concerned, field measurements indicate a rather slow conversion rate (about 0.3% per hour).

33745 **(LA—8938-MS) Reduction of photosynthetically active radiation under extreme stratospheric aerosol loads.** Gerstl, S.A.W.; Zardecki, A. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 24p. NTIS, PC A02/MF A01. Order Number DE81030506.

The recently published hypothesis that the Cretaceous-Tertiary extinctions might be caused by an obstruction of sunlight is tested by model calculations. First we compute the total mass of stratospheric aerosols under normal atmospheric conditions for four different (measured) aerosol size distributions and vertical profiles. For comparison, the stratospheric dust masses after four volcanic eruptions are also evaluated. Detailed solar radiative transfer calculations are then performed for artificially increased aerosol amounts until the postulated darkness scenario is obtained. Thus we find that a total stratospheric aerosol mass between 1 and 4 times $10^1$ g is sufficient to reduce photosynthesis to $10^{-3}$ of normal. We also infer from this result tha the impact of a 0.4- to 3-km-diameter asteroid or a close encounter with a Halley-size comet may deposit that amount of particulates into the stratosphere. The darkness scenario of Alvarez et al. is thus shown to be a possible extinction mechanism, even with smaller size asteroids of comets than previously estimated.

33746 **(LBL—11986) Environmental pollutant studies: FY 1980.** (Lawrence Berkeley Lab., CA (USA)). Feb 1981. Contract W-7405-ENG-48. 55p. NTIS, PC A04/MF A01. Order Number DE81028051.

Separate abstracts were prepared for the 16 papers presented in this annual report of the Energy and Environment Division. (KRM)

33747 (LBL—11986, pp 5.1-5.4) **Activated carbon catalyzed oxidation of aqueous S(IV) species.** Brodzinsky, R.; Chang, S.; Markowitz, S.; Novakov, T. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

The formation of acid rains is a source of major interest and concern. Acid rain is caused by nitric and sulfuric acids that are formed by the oxidation of nitrogen oxides (NO/sub x/) and sulfur dioxide ($SO_2$). Many mechanisms are known for the oxidation of $SO_2$. We have been studying the catalytic effects of carbonaceous soot particles and activated carbons on this reaction. Carbonaceous particles in aqueous suspension were found to be efficient catalysts for the oxidation of aqueous sulfur (IV) [S(IV)] species. We propose a possible four-step reaction mechanism which consists of the adsorption of a dissolved $O_2$ molecule onto the carbon surface, followed by the adsorption of 2 S(IV) molecules or ions. These are oxidized on the surface to sulfate, which desorbs from the surface, regenerating the catalytically active site.

33748 (LBL—11986, pp 5.5-5.7) **Oxidation of $SO_2$ by wet soot particles: application to clouds, fogs, and plumes.** Benner, W.; Brodzinsky, R.; Novakov, T. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

In laboratory studies, the exposure of dispersed wet soot particles of $SO_2$ simulates reactions which could occur in clouds, fogs, and plumes. Such dispersed droplet studies would also supply information that could be introduced into computer models to evaluate the relative importance of the soot-fog-$SO_2$ mechanisms for sulfate formation in the atmosphere. To meet our experimental objectives, we constructed a fog chamber in which stable fogs could be exposed to pollutant gases. The fog chamber work presented in this paper is not intended as a rigorous kinetic study; these experiments were conducted to show that $SO_2$ can be oxidized in droplets that contain soot particles.

33749 (LBL—11986, pp 5.7-5.10) **Aqueous reactions of nitrite and bisulfite.** Oblath, S.; Chang, S.; Markowitz, S.; Novakov, T. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

Several years ago we began a study to investigate the reactions of nitrite ($NO_2^-$) and bisulfite ($HSO_3^-$) as a first step toward understanding the NO/sub x//$SO_2$/$H_2O$ system. Nitrite is known to react with bisulfite over a wide range of conditions. All the known

aqueous reactions of nitrite with bisulfite begin with the formation of hydroxylamine disulfonate (HADS). Work has been progressing during the past year to answer several questions pertaining to the formation of HADS: (1) Is a process independent of bisulfite concentration really present, as noted in the literature; (2) What role will carbon particles have in this reaction; and (3) What effect will extremely low reactant concentrations (or high acidity) have on the products or rate of the nitrite-bisulfite reaction.

33750 (LBL—11986, pp 5.10-5.12) **Importance of soot particles and nitrous acid oxidizing $SO_2$ in atmospheric aqueous droplets.** Chang, S.; Toossi, R.; Novakov, T. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

Sulfuric and nitric acids make a major contribution to the acidity of rain water. In our laboratory we found two previously unrecognized reaction pathways which involve water droplets and could be important processes in the genesis of acid rain and sulfate aerosols: (1) oxidation of $SO_2$ in water droplets containing soot particles and (2) oxidation of $SO_2$ by $HNO_2$ in water droplets. Here we discuss the impact of these two systems on atmospheric sulfate aerosol formation.

33751 (LBL—11986, pp 5.13-5.14) **Kinetics of the reaction between $NH_2OH$ and $SO_2$ in aqueous solutions.** Gomiscek, S.; Clem, R.; Novakov, T.; Chang, S. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

Hydroxylamine, one of the species produced as a result of interaction between NO/sub x/ and $SO_2$ in aqueous solution can undergo further reaction with $SO_2$ to form either sulfamic acid or ammonium bisulfate. We have investigated the kinetics of this latter reaction as part of an effort to understand the importance of the interaction of NO/sub x/ with $SO_2$ in atmospheric aqueous droplets in terms of acid rain and sulfate aerosol formation.

33752 (LBL—11986, pp 5.15-5.18) **Role of fly ash in the catalytic oxidation of $SO_2$.** Cohen, S.; Chang, S.; Markowitz, S.; Novakov, T. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

In this study the oxidation of S(IV) in slurries of fly ash has been examined after different ash pretreatment and under varying experimental conditions. Our evidence indicates that dissolved iron is a prime factor in fly-ash-catalyzed oxidation of $SO_2$.

33753 (LBL—11986, pp 5.19-5.22) **Soot in the Arctic.** Rosen, H.; Novakov, T.; Bodhaine, B. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

Recent studies in the Arctic show the presence of large aerosol concentrations that significantly affect optical transfer through the atmosphere and lead to the phenomenon of Arctic haze. Recent studies of the urban aerosol indicate the presence of substantial graphitic carbon concentrations. These graphitic species are very effective absorbers of visible radiation and are responsible for the high optical absorption coefficients which have recently been observed in urban air. The impacts of these highly absorbing particles on a regional or global scale have not been assessed so far, but they could be important, especially over regions with a high surface albedo like the polar icecaps. Furthermore, graphitic carbon can only be produced from combustion processes, and therefore it can offer a very attractive and convenient tracer for anthropogenic activity.

33754 (LBL—11986, pp 5.23-5.25) **Intercomparison of the integrating plate and the laser transmission methods for determination of aerosol absorption coefficients.** Sadler, M.; Charlson, R.; Rosen, H.; Novakov, T. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

Recent studies of atmospheric aerosol particles indicate the presence of a large, optically absorbing component which can cause both visibility degradation and climatic effects. There are two approaches in use for assessing light absorption by particles. One set of methods aims at establishing the absorption coefficient in the atmosphere. This paper will compare the absorption coefficients determined by the integrating plate method and the laser transmission method at a wide range of sites. Furthermore, these absorption coefficients will be correlated to the total carbon content of the aerosol.

33755 (LBL—11986, pp 5.26-5.30) **Determination of black carbon by thermal analysis.** Gundel, L.; Dod, R.; Novakov, T. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

Previous work at Lawrence Berkeley Laboratory (LBL) has shown that attenuation of visible light as it passes through ambient of source-particulate-loaded filters is related to concentrations of black carbon. In order to measure concentrations of black carbon on filters by optical attenuation, a direct determination of black carbon is necessary. One method of identifying black carbon is optico-thermal analysis, a combustion thermal analysis in which both the product $CO_2$ concentration and the optical transmission of the material are continuously monitored. This method yields simultaneous measurement of the amount of particulate carbon burned and of the change in light transmission through the filter sample as temperature-programmed combustion proceeds. For some types of samples, primarily those collected directly from combustion sources, the black carbon can be unambiguously identified and quantified from the thermogram.

33756 (LBL—11986, pp 5.30-5.32) **Model for the progressive combustion analysis of carbonaceous aerosol particles.** Hansen, A.; Novakov, T. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

The analysis of aerosol particles by progressive thermal decomposition was first reported by Malissa et al. and has subsequently been developed into a powerful method for the qualitative and quantitative analysis of carbonaceous and nitrogenous aerosols. This paper presents a model for the combustion process that may be fit to the data to yield further information on the nature of the carbonaceous species.

33757 (LBL—11986, pp 5.32-5.34) **Relation between concentrations of polynuclear aromatic hydrocarbons and black carbon.** Gundel, L.; Rosen, H.; Novakov, T. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

We have developed an optical attenuation technique to measure the black carbon content in particulate material. In addition to the black carbon, particulate organic carbon in ambient aerosols also contains primary organics, directly produced from combustion sources. This primary organic carbon together with black carbon is defined as soot. We have studied the relationship between the black carbon concentration and one class of primary organic compounds, polynuclear aromatic hydrocarbons (PAH) in urban carbonaceous particles. These compounds and their oxidized derivatives may constitute the health hazard associated with ambient and source carbonaceous particles.

33758 **(LBL—12887) Indoor air quality.** Hollowell, C.D. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 13p. (CONF-810909—4). NTIS, PC A02/MF A01. Order Number DE81029857.

From Institute of Gas Research conference; Los Angeles, CA, USA (28 Sep 1981).

Rising energy prices, among other factors, have generated an incentive to reduce ventilation rates and thereby reduce the cost of heating and cooling buildings. Reduced ventilation in buildings may significantly increase exposure to indoor air pollution and perhaps have adverse effects on occupant health and comfort. Preliminary findings suggest that reduced ventilation may adversely affect indoor air quality unless appropriate control strategies are undertaken. The strategies used to control indoor air pollution depend on the specific pollutant or class of pollutants encountered, and differ somewhat depending on whether the application is to an existing building or a new building under design and construction. Whenever possible, the first course of action is prevention or reduction of pollutant emissions at the source. In most buildings, control measures involve a combination of prevention, removal, and suppres-

sion. Common sources of indoor air pollution in buildings, the specific pollutants emitted by each source, the potential health effects, and possible control techniques are discussed.

33759 (ORNL/TM—7744, pp 43-47) **Studies at Plant Bowen: temperature/humidity plumes and condensate scavenging.** Nickola, P.W. (Pacific Northwest Lab., Richland, WA). Sep 1981. NTIS, PC A05/MF A01. Order Number DE81030431.

In Meteorological Effects of Thermal Energy Releases (METER) program. Annual progress report, October 1979-September 1980.

The magnitude and extent of Plant Bowen cooling tower temperature/humidity plumes and rainfall scavenging of the cooling tower plume condensate were measured as a part of the Winter Study of Power Plant Effects (WISPE). Interpretation of plume temperature/humidity characteristics was limited by changes in atmospheric conditions during the time between the ambient and in-plume measurements. The study of rainfall enhancement (scavenging) immediately below the plume was inconclusive due to the modest magnitude and duration of the single rainfall occurrence in the test period.

33760 (PNL-SA—8432) **Comparison of regional scale effects of in-cloud conversion of $SO_2$ to $SO_4$/sup =/ in an eight-layer diabatic model with a single-layer model.** Davis, W.E. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1981. Contract AC06-76RL01830. 16p. (CONF-810841—2). NTIS, PC A02/MF A01. Order Number DE81030084.

From 12. NATO/CCMS international technical meeting on air pollution modeling and its applications; Menlo Park, CA, USA (25 Aug 1981).

Multilayer and single layer regional scale models were used in a short term assessment during two frontal storms in October, 1977. A comparison was made of results of the assessments for $SO_4$/sup =/ air concentrations and using an in-cloud $SO_4$/sup =/ wet deposition conversion, an in-rain conversion and no in-cloud or in-rain conversion in the multilayer model with observed values. Also an assessment using in-rain conversion using a single layer model was compared with observations. The results were mixed in that the multilayer model with no in-cloud or in-rain conversion yielded the best $SO_4$/sup =/ air concentration patterns while the multilayer model using in-cloud conversion yielded the best fit to observed wet deposition of $SO_4$/sup =/. Further work is necessary since only 35% of the sources were represented for the northeast United States in this study.

33761 (PNL-SA—9606) **Assessment of the long-range transport of residential woodstove fine-particulate emissions for two future United States energy scenarios.** Allwine, K.J. Jr. (Pacific Northwest Lab., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 17p. (CONF-810674—5). NTIS, PC A02/MF A01. Order Number DE81030096.

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

This analysis of the impact of solar energy technologies (especially woodstoves) on regional scale fine particulate air quality resulting from direct-energy-use sources is a good first-order approximation. In general it was shown that significant interregional transport of fine particulates can occur especially into the 3 northeastern regions of the US. No regional scale air pollution problems were identified unless at a later time one of the toxic materials present in fine particulates is found to be harmful at the fine particulate concentrations reported. Results also indicate that concentrations are low relative to any current particulate standards. The maximum in 1975 was computed to be 3.54 $\mu g/m^3$ for the Middle Atlantic region decreasing to a maximum in 2000 of 2.83 $\mu g/m^3$ (high scenario) for the New York-New Jersey region. The maximum from woodstoves was computed to be .27 $\mu g/m^3$ in 1975 and .82 $\mu g/m^3$ in 2000 (high scenario). Both maximums occurred in the Middle Atlantic region. The concentrations in the eastern 5 regions are predicted to decrease from 1975 to 2000 (both scenarios) whereas the opposite is true for the western 5 regions. The contributions from woodstoves are projected to increase in all regions. Higher concentrations are predicted for the high scenario than the low scenario for all regions. The increases range from .01 $\mu g/m^3$ in the Mountain region to .26 $\mu g/m^3$ in both the Middle Atlantic and Southeast regions. The majority of this increase is due to woodstoves. For the three northeastern regions more than 50 percent of the impact on each region is from outside the respective region.

33762 (UCRL—85035) **Elemental composition of atmospheric fine-particles emitted from coal burned in a modern electric power plant equipped with a flue-gas desulfurization system.** Ondov, J.M.; Biermann, A.H.; Heft, R.E.; Koszykowski, R.F. (Lawrence Livermore National Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 19p. (CONF-801266—1). NTIS, PC A02/MF A01. Order Number DE81030073.

From American Chemical Society meeting; Las Vegas, NV, USA (1 Dec 1980).

Improved control devices now frequently installed on conventional coal-utility boilers drastically affect the quantity, chemical composition, and physical characteristics of fine-particles emitted to the atmosphere from these sources. Fly-ash aerosols were sampled upstream and downstream from a modern lime-slurry, spray-tower system installed on a 430-Mw(e) coal utility boiler. Particulate samples were collected in situ on membrane filters and in University of Washington MKIII and MKV cascade impactors. The MKV impactor, operated at reduced pressure and with a cyclone preseparator, provided 13 discrete particle-size fractions with median diameters ranging from 0.07 to 20 mu m; with up to 6 of the fractions in the highly respirable submicron particle range. The concentrations of up to 35 elements and estimates of the size distributions of particles in each of the fly-ash fractions were determined by instrumental neutron activation analysis and by electron microscopy, respectively. Mechanisms of fine-particle formation and chemical enrichment in the flue-gas desulfurization system are discussed.

33763 **Precision of the all-glass impinger and the Andersen microbial impactor for air sampling in solid-waste handling facilities.** Lembke, L.L. (Ames Lab., IA); Kniseley, R.N.; Van Nostrand, R.C.; Hale, M.D. Contract W-7405-ENG-82. *Applied and Environmental Microbiology ;* **42**: No. 2, 222-225(Aug 1981).

A method was devised to determine the precision of the all-glass impinger and the Andersen six-stage microbial impactor over a wide range of aerosol concentrations like those found in facilities which process solid waste. Simultaneous samples were collected inside a municipal solid-waste recovery system, and the data were treated statistically to estimate the precision of each air-sampling device. All-glass impingers yielded colony counts which indicated a linear relationship between samplers over an observed aerosol concentration of $1.1 \times 10^3$ to $2.8 \times 10^7$ colony-forming units per $m^3$ of air. Impactors also yielded colony counts which indicated a linear relationship over an observed aerosol concentration range of $3.9 \times 10^3$ to $1.9 \times 10^5$ colony-forming units per $m^3$ of air. The coefficients of variation for the all-glass impinger and the six-stage impactor in an environment with a high and variable dust level were determined to be 0.38 and 0.23, respectively.

33764 **$CO_2$ and acid rain.** *Oak Ridge National Laboratory Review (United States) ;* **14**: No. 1, 58-60(1981).

Increased emissions of carbon dioxide associated with an escalation in fossil fuel combustion and conversion could have serious implications for global climate. ORNL plans to assess available physical, biological, and social science facts and prepare an integrated evaluation of the likely direction and consequences of fossil fuel combustion, with respect to CO2 emissions. The problems associated with acid rain include reduced crop yields, structural damage to buildings and statues, serious pollution of lakes and streams, and possible health effects such as eye, skin, and lung irritation. ORNL's role in investigating the causes of acid rain is discussed.

## 5003 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 33361, 33758, 33801, 33802*

**33765** (CONF-800433—, pp 534-539) **Evaluation of airborne radioactive Iodine and noble gas environmental monitors using short-lived research reactor-produced radionuclides.** Jester, W.A.; Wallace, J.H. (Pennsylvania State Univ., University Park). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Techniques have been developed in this work to allow for testing of air monitoring systems designed to quantify noble fission gases and airborne iodine and organic iodide under a wide variety of radionuclide concentrations, humidity conditions, and radiation background intensities. These techniques have been successfully employed in the evaluation of a commercial particulate, iodine, and noble gas air monitoring system. The use of research reactor-produced radionuclides having short half-lives facilitates such testing by eliminating waste disposal and system decontamination problems associated with the use of longer-lived fission gases.

**33766** **(LBL—10769) Alpha-spectroscopic techniques for field measurement of radon daughters.** Nazaroff, W.W.; Nero, A.V.; Revzan, K.L. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 15p. (CONF-810153—1). NTIS, PC A02/MF A01. Order Number DE81029846.

From 2. special symposium on natural radiation environment; Bombay, India (19 Jan 1981).

Alpha spectroscopic techniques have not often been used to measure radon daughter concentrations in field studies because the equipment required is bulky and expensive. With advances in integrated circuit technology, less expensive, portable instruments have been developed that now make it possible to use these techniques to measure the low concentrations of radon daughters typically found indoors. One of two procedures may be used, two-count or single-count, depending on whether precision of measurement or rapidity of measurement is the more important objective. We have analyzed the effectiveness of both procedures. The results show that the two-count method permits individual radon daughter concentrations to be measured at the low level of one picocurie per liter with a relative standard deviation of about 20% within a total measurement time of 40 minutes (assuming the product of detector efficiency and sampling flow rate is one liter per minute). With the single-count procedure, using the same assumption, potential alpha energy concentration can be estimated within a total measurement time of 11 minutes with less than 20% relative procedural error for common equilibrium conditions; the relative standard deviation is about 20% at 0.005 working level. These findings are compared with results obtained by other commonly used procedures.

**33767** **(PNL-SA—9140) Environmental concentration and migration of $^{129}$I.** Brauer, F.P.; Strebin, R.S. Jr. (Pacific Northwest Lab., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 22p. (CONF-810722—12). NTIS, PC A02/MF A01. Order Number DE81030093.

From International symposium on migration in the terrestrial environment of long-lived radionuclides from the nuclear fuel cycle; Knoxville, TN, USA (27 Jul 1981).

Local sources of $^{129}$I suitable for study of migration in the environment are uranium ore bodies for long periods and nuclear fuel reprocessing operations for recent time periods. Uranium ores produce $^{129}$I from spontaneous and neutron-induced fission. Nuclear fuel reprocessing has resulted in releases of $^{129}$I to both the atmosphere and the hydrosphere. The long term fate of surface-deposited and groundwater $^{129}$I was studied. Neutron activation analysis was used to measure the low levels of $^{129}$I and natural $^{127}$I in samples near and remote from nuclear fuel reprocessing facilities. Measurements were made on air samples, vegetation, soil, surface water, groundwater, and uranium ore samples. The $^{129}$I was found to accumulate in the top soil and litter layer. The surface concentrations of $^{129}$I in forest communities were found to be several times higher than for nearby grass communities. The $^{129}$I levels were found to persist in the environment after reprocessing activities had been discontinued. Measurable $^{129}$I was found to be contained in uranium ore samples from a variety of locations and with a range of uranium concentrations. Thus ore bodies constitute a source of $^{129}$I suitable for study of migration over long time periods. Iodine-$^{129}$ has entered surface and groundwater as the result of liquid and atmospheric discharges from nuclear fuel reprocessing facilities. The iodine in water samples was found to be anionic and travel with the water flow. Thus $^{129}$I was found to provide high sensitivity for hydrology tracer studies and radioactivity migration surveillance. Once $^{129}$I enters the hydrosphere it migrates with the water with little or no hold-up by exchange with cationic exchangers such as soil or silt.

**33768** **(RFP—2462-Add.) Probabilities of aircraft crashes at Rocky Flats and subsequent radioactive releases.** Selvidge, J. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 29 Jul 1981. Contract AC04-76DP03533. 7p. NTIS, PC A02/MF A01. Order Number DE81028516.

Step-by-step calculations are described for determining the probability of plutonium being released and the amount involved based on possible damage conditions due to aircraft crashes into plutonium areas at Rocky Flats. The paper is a technical supplement to an earlier report, RFP-2462, entitled probabilities of aircraft crashes at Rocky Flats and subsequent radioactive releases. The procedure for computing the probability of release of a specific amount of plutonium is repeated for every path from the beginning of the tree through to each of the end points. The conditional probabilities at each step are found and multiplied together to obtain the final probability at an end point (i.e., the probability of the full sequence of events). The complete event tree in this analysis has 309 end points.

## 5004 Thermal Effluents Monitoring And Transport

*REFER ALSO TO CITATION(S) 33722, 33759, 33770*

**33769** **(ORNL/TM—7744) Meteorological Effects of Thermal Energy Releases (METER) program. Annual progress report, October 1979-September 1980.** Hoffman, H.W.; Patrinos, A.A.N. (comps.). (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 87p. NTIS, PC A05/MF A01. Order Number DE81030431.

The METER program (Meteorological Effects of Thermal Energy Releases) was initiated at the beginning of FY 1976 (July 1, 1975) to determine the potential for weather modification arising from the heat and moisture introduced to the atmosphere by the evaporative cooling towers at electric generating plants. The principal program focus has been precipitation modification with concentration on the acquisition of rainfall data at the coal-fueled Bowen Electric Generating Plant in northwestern Georgia. This report is the fifth in the series of progress reports documenting program activities. Separate abstracts have been prepared for each of the three sections of the report.

## 5006 Regulations

**33770** **(BNL—51389) Impacts of Federal clean air law on district-heating opportunities.** Baram, M.S.; Miyares, J.R. (Brookhaven National Lab., Upton, NY (USA). National Center for Analysis of Energy Systems). Mar 1981. Contract AC02-76CH00016. 26p. NTIS, PC A03/MF A01. Order Number DE81030095.

District heating facilities are likely to be easier to site in attainment areas - those that have achieved National Ambient Air Quality Standards (NAAQS) - than in areas where these standards have not been met (nonattainment areas). Under review procedures aimed at Prevention of Significant Deterioration (PSD) of air quality in attainment areas, approval would be virtually automatic if a district heating plant would result in net air quality improvement. Thus, district heating proponents would do well to focus their efforts on servicing existing buildings in areas that have attained NAAQS for particulate matter, sulfur dioxide, and nitrogen dioxide. In a nonattainment area, actual emission reductions - not merely air quality improvements - must be produced before a new plant can be approved during New Source Review (NSR). Converting conventional electric plants to cogeneration may produce emission reductions from individual furnace shutdowns in the build-

ings to be serviced by the plants sufficient to offset emission increases from the plant itself. Thus, NSR approval is most readily available for such conversions, and the focus of any efforts to employ district heating technology in nonattainment areas should be on converting existing conventional plants to cogeneration. No exemptions from NSR or PSD review requirements now exist for district heating systems. Nor do present emission offset regulations governing NSR account for the phenomenon, associated with some district heating configurations, of air quality improvement despite emission increases. Existing statutory provisions would have to be amended before the US Environmental Protection Agency (EPA) can implement either a blanket district heating exemption or a case-by-case waiver of the emission offset requirement where air quality benefits are expected.

33771 (DOE/EP/10012—1, pp 7-22) **Air pollution.** Jun 1981. NTIS, PC A06/MF A01.

In Energy and environmental quality: case histories of impact management.

An introduction of existing legal aspects and regulations within which energy projects are designed and operated are discussed along with technical trends. Case studies are used to emphasize historical and background problems associated with environmental problems and goals dealing with air pollution. (DLS)

# 51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

## 5101 Basic Studies

*REFER ALSO TO CITATION(S) 33886*

33772 (CONF-800433—, pp 15-24) **Comparisons of peak-search and photopeak-integration methods in the computer analysis of gamma-ray spectra.** Baedecker, P.A. (Geological Survey, Reston, VA). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Myriad methods have been devised for extracting quantitative information from gamma-ray spectra by means of a computer, and a critical evaluation of the relative merits of the various programs that have been written would represent a Herculean, if not an impossible, task. The results from the International Atomic Energy Agency (IAEA) intercomparison, which may represent the most straightforward approach to making such an evaluation, showed a wide range in the quality of the results - even among laboratories where similar methods were used. The most clear-cut way of differentiating between programs is by the method used to evaluate peak areas: by the iterative fitting of the spectral features to an often complex model, or by a simple summation procedure. Previous comparisons have shown that relatively simple algorithms can compete favorably with fitting procedures, although fitting holds the greatest promise for the detection and measurement of complex peaks. However, fitting algorithms, which are generally complex and time consuming, are often ruled out by practical limitations based on the type of computing equipment available, cost limitations, the number of spectra to be processed in a given time period, and the ultimate goal of the analysis. Comparisons of methods can be useful, however, in helping to illustrate the limitations of the various algorithms that have been devised. This paper presents a limited review of some of the more common peak-search and peak-integration methods, along with Peak-search procedures.

33773 (CONF-800433—, pp 25-35) **Accuracy in activation analysis: count rate effects.** Lindstrom, R.M.; Fleming, R.F. (National Bureau of Standards, Washington, DC). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The accuracy inherent in activation analysis is ultimately limited by the uncertainty of counting statistics. When careful attention is paid to detail, several workers have shown that all systematic errors can be reduced to an insignificant fraction of the total uncertainty, even when the statistical limit is well below one percent. A matter of particular importance is the reduction of errors due to high counting rate. The loss of counts due to random coincidence (pulse pileup) in the amplifier and to digitization time in the ADC may be treated as a series combination of extending and non-extending dead times, respectively. The two effects are experimentally distinct. Live timer circuits in commercial multi-channel analyzers compensate properly for ADC dead time for long-lived sources, but not for pileup. Several satisfactory solutions are available, including pileup rejection and dead time correction circuits, loss-free ADCs, and computed corrections in a calibrated system. These methods are sufficiently reliable and well understood that a decaying source can be measured routinely with acceptably small errors at a dead time as high as 20 percent.

33774 (CONF-800433—, pp 36-44) **Random search algorithm for spectrum analysis.** Takeda, Y. (Tohoku Univ., Sendai, Japan). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The random search algorithm was applied to various spectrum analyses and related curve fitting problems. This algorithm has several advantages over other conventional methods. Especially its robust and easily applicable properties are outstanding. These characteristics of this algorithm are shown through analyzing various kinds of spectra. The possibility to reduce the total computing time is also discussed.

33775 (CONF-800433—, pp 549-559) **Trace element analysis of wild rodent tissues using the PIXE method.** Hill, M.W.; Mangelson, N.F.; Ryder, J.F.; Atwood, N.D.; Wood, B.W. (Brigham Young Univ., Provo, UT). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Five species of rodents have been collected in an area near Lake Powell Utah. Common names of the five species are: Long-tailed Mouse, Small Pocket Mouse, Deer Mouse, Antelope Ground Squirrel and Kangaroo Rat. Liver, lung, kidney and hair tissues from each animal were analyzed for trace element content by proton particle-induced x-ray emission (proton PIXE) analysis. Mean concentrations for the following elements were established for the tissues of each animal type: K, Ca, Ti, Mn, Fe, Ni, Cu, Zn, Se, Br, Rb and Pb. Analyses of variance were performed on the set of elements common to all tissues. Some significant differences in element concentrations were found between animal species and between tissue types. These differences lead to the following orders based on element concentration: Long-tailed Mouse $\geqq$ Antelope Ground Squirrel $\geqq$ Kangaroo Rat $\geqq$ Small Pocket Mouse and liver $\geqq$ kidney $\geqq$ lung $\geqq$ hair. Linear regression analyses were also performed on mean elemental concentrations in tissues. These analyses lead to several conclusions. First, the pattern of trace element concentrations in each of the four tissues is the same in all five species. Second, the pattern of trace element concentrations is the same in all four tissues of one species with the exception of Ti and Fe in hair. Third, the variation of an element in the hair cannot predict the variation of that same element in the other three tissues. Only K, Ca, Ti, Mn, Fe, Cu, and Zn were included in the third study.

33776 (CONF-800433—, pp 587-596) **Nuclear methods in coal research.** Lyon, W.S. (Oak Ridge National Lab., TN). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Nuclear methods, particularly neutron activation analysis (NAA) provide useful information about elemental constituents in coal and fly ash, but often other techniques are required to supplement NAA data. Spark source mass spectrometry and atomic absorption have been studied as methods for determination of certain elements in coal that are not easily measured by NAA. In work concerned with the chemical speciation of elements in fly ash, a number of analytical techniques have been used; these include NAA, chemical etching and separation, optical and electron microscopy and x-ray diffraction.

**33777** (CONF-800433—, pp 597-603) **Instrumental prompt gamma activation analysis of energy-related samples and standards.** Anderson, D.L.; Failey, M.P.; Gordon, G.E.; Zoller, W.H. (Univ. of Maryland, College Park). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Instrumental thermal neutron prompt-gamma activation analysis (PGAA) is a powerful method for multi-elemental characterization of fuels and related materials. Samples of several types of fuels were irradiated and counted at the University of Maryland's PGAA facility at the National Bureau of Standards (NBS) reactor. The beam extraction system consists of a lower beam thimble and shutter apparatus extending from atop the reactor to a location in the $D_2O$ moderator next to the core. An upper beam tube provides neutron shielding and a location for sample placement. Sample sizes ranged from 0.1 to 2.5 g, and irradiation times were typically 4 to 20 hours, with a thermal [Cd(Au) ratio = 55] beam flux of 2 x $10^8$ n/$cm^2$-sec. The detection system consisted of a Ge(Li) of 24% relative efficiency surrounded by a large, split-annulus NaI detector, permitting the simultaneous accumulation of singles, Compton-suppressed, and pair spectra from 0.05 to 11 MeV. Coals, fuel oils, fly ashes and several other energy-related sample types may be analyzed for some or all of the following elements: H, B, C, N, Na, Mg, Al, Si, S, Cl, K, Ca, Ti, V, Mn, Fe, Cd, Nd, Sm and Gd. Thus, the PGAA technique can readily provide information on the environmentally important elements N and S, as well as other elements that are measures of the ash, moisture and heat content. Also, in the case of coal, the method can be used to determine concentrations of the trace elements B, Nd, Sm and Gd. These measurements are all non-destructive and many of them can be done in real time on fossil-fuel streams in plants.

**33778** (CONF-800433—, pp 604-611) **Assessments of accuracy and precision of multi-element determinations in whole coal by non-destructive neutron activation analysis.** Miller, G.E.; Burtner, D.R.; Jerabek, P.A. (Univ. of California, Irvine). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Factors affecting the accuracy and precision of element determinations of samples of coal using instrumental neutron activation analysis are examined in some detail. In the case of nitrogen determination using 14-MeV neutrons, it is concluded that several correction factors for interference reactions must be determined fairly precisely in order that the analytical technique can be applied routinely to samples of widely varying composition.

**33779** (CONF-800433—, pp 612-620) **Study of coal oxidation by charged particle activation analysis.** Schlyer, D.J.; Wolf, A.P. (Brookhaven National Lab., Upton, NY). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

It has been possible, using the technique of changed particle activation analysis, to follow the time course of the oxidation of coal exposed to air. The kinetics have been studied and seem to be consistent with a rapid initial uptake of oxygen containing molecules followed by slow diffusion into the surface of the coal particles. In this latter regard a study has been undertaken to study the depth profile of the oxygen into the coal particle surface. The depth of penetration of the activating particle is determined by the incident energy and therefore, by comparison to the appropriate standards, the depth profile may be determined either by varying the incident energy or by varying the particle size. Both approaches have been used and give consistent results. The depth to which a significant amount of oxygen penetrates varies from about 3 μm for very high rank coals to about 20 μm for low rank coals. This diffusion depth seems to be related to the porosity of the coals. A model for the low temperature air oxidation of coal has been developed to explain the results from the above mentioned experiments.

**33780** (CONF-800433—, pp 621-635) **Classification of coal by trace analysis using INAA-clusteranalysis and leaching of precipitator ash.** van der Sloot, H.A. (Netherlands Energy Research Foundation, Petten). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

In The Netherlands the coal used for energy production is imported from many different countries. This implies a great variability of the (trace) element levels in the ash produced which in turn has implications for disposal and the preferred application in industry. To get hold of this variability in precipitator ashes obtained from coals of different origin a classification of coal was performed with clusteranalysis using the elemental composition (CLUSTAN-1C package). In addition to the measurement of elemental concentrations in coal and ash, leaching experiments were performed with precipitator ash. Elements which are leached appreciably are the halogens, $SO_4^{2-}$, Mo, W, Cd and Hg. Arsenic and selenium are hardly leached from the alkaline ash studied.

**33781** (CONF-800433—, pp 645-661) **Nuclear techniques for the on-line bulk analysis of coal.** Sowerby, B.D.; Watt, J.S. (Australian Atomic Energy Commission, Sutherland). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Several research projects are being undertaken at the Australian Atomic Energy Commission (AAEC) on the development of neutron, γ-ray and x-ray techniques for bulk coal analysis. Two projects described in the present paper are the development of neutron techniques for the determination of carbon and specific energy, and the development of x-ray techniques for the determination of ash.

**33782** (CONF-800433—, pp 685-691) **Variation of minor and trace elements in coals from unknown geologic settings.** Bailey, A. (Marshall Univ., Huntington, WV); Jones, J. 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

To determine chemical differences between coals formed in different environments, samples of West Virginia Pocahontas No. 3 and Pocahontas No. 2 coals were analyzed for a wide range of elements using neutron activation, x-ray and atomic absorption analysis. The samples consisted of the $<1.55$ specific gravity fraction of core taken from an area where the geologic environments have been determined as part of a recent doctoral dissertation. Specifically, rocks associated with the coals show that the Pocahontas No. 2 in this area was formed in a swamp that developed on a uniform platform open to marine influences, while the Pocahontas No. 3 was influenced by a river system and protected from marine influences by barrier bars that developed between the sea and the platform.

**33783** (CONF-800433—, pp 692-704) **Determination of mineral matter in coal by target transformation factor analysis.** Roscoe, B.A.; Hopke, P.K. (Univ. of Illinois, Urbana). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

There is an increasing need to determine the nature of mineral matter in coal. The mineral matter is composed of all inclusions in the coal whether or not they are distinct from the coal. The need for this information is based on the increased use of coal and the problems associated with its use such as boiler tube fouling, air pollution, and coal liquefaction. By utilizing target transformation factor analysis, it is possible to identify the number of mineral phases that may be present in the coal as well as the composition of these mineral phases including major, minor, and trace elements. It is thus possible to determine the mineral phases and reconstruct the mineralogy of the coal sampled such that general characteristics of the mineral phases can be determined. From this information, in-

sight into the formation of the coal can be obtained and better methods of utilizing the coal can be devised.

## 5102 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 32869, 33729, 33731, 33732, 33733, 33734, 33735, 33736, 33813, 33814, 33817, 33907*

33784 (CONF-800433—) **Nuclear methods in environmental and energy research.** Vogt, J.R. (ed.). (Missouri Univ., Columbia (USA)). 1980. Contract AC02-80EV10318. 792p. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

A total of 75 papers were presented on nuclear methods for analysis of environmental and biological samples. Sessions were devoted to software and mathematical methods; nuclear methods in atmospheric and water research; nuclear and atomic methodology; nuclear methods in biology and medicine; and nuclear methods in energy research.

33785 (CONF-800433—, pp 127-134) **Neutron activation for the determination of total halogenated organics.** Reach, C.D. Jr.; Meiburger, P.F.; O'Connor, J.T. (Univ. of Missouri, Columbia). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The disposal of hazardous chemical wastes is one of the most critical and far-reaching problems facing the industrialized world. Enforcement of new federal and state regulations will require the development of a cost effective analytical procedure which is sensitive to many toxic waste substances. The application of neutron activation analysis for organohalide detection is presented as a predisposing and complementary method to gas and liquid chromatography procedures for priority pollutant analyses. The concept is introduced that NAA offers an unprecedented broad-spectrum monitoring technique in the ability to determine a toxic substance parameter known as the organohalides.

33786 (CONF-800433—, pp 159-168) **Multielement analysis of soil of a sewage-farm by photon and neutron activation analysis using waste incineration ash as reference material.** Schmitt, B.F.; Segebade, C.; Fusban, H.U. (Bundesanstalt fuer Materialpruefung, Berlin, Germany). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Soil samples from a waste water cleaning facility in Berlin have been analyzed using several activation analysis methods. 43 elements have been determined by instrumental high energy photon analysis, and 14 MeV-neutron activation analysis. Conventional gamma ray spectroscopy and low energy photon spectroscopy have been applied for product activity measurement. It has turned out that these methods in combination offer a large spectrum of analytical information. Fly ash of a waste incineration facility in Berlin has been used as a reference material. This ash has been found to be suitable particularly for environmental analyses, since toxic elements are present in comparably high concentration levels. Both the preparation of this multielement reference material and its application for the soil analysis are discussed.

33787 (CONF-800433—, pp 216-230) **Feasibility of trace multielement analysis by 14-MeV neutron activation.** Williams, R.E. (Univ. of Illinois, Urbana); Hopke, P.K.; Meyer, R.A. 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Instrumental Fast Neutron Activation Analysis of NBS Fly Ash, Orchard Leaves, and Bovine Liver was performed using the ICT (Insulated Core Transformer) intense neutron source at LLL. The high 14-MeV neutron flux allowed concentration determinations of up to 20 elements from the set of Na, Mg, Al, Si, P, K, Sc, Ti, Fe, Co, Ni, Zn, As, Se, Rb, Sr, Y, Zr, Mo, Sb, Ba, Ce, Tl, and Pb. Problems with interferences and steep flux gradients are discussed. The elemental profile obtained is the most complete analysis to date using FNAA.

33788 (CONF-800433—, pp 247-257) **Prompt neutron capture gamma ray analysis of nuclear fuel materials with a pair spectrometer.** Pecequilo, B.R.S.; Vandenput, G.C.; Stopa, C.R.S.; Suarez, A.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, Brazil). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Prompt gamma rays following thermal neutron capture are used to determine fuel material impurities in a reactor internal geometry. In order to increase the detection sensitivity for weak lines and simplify the analysis of the spectra, a 3-crystal coincidence spectrometer was mounted and the gain in peak-to-background ratio calculated for several spectra was about a factor of 6. The calibration of the experimental arrangement was performed with $UO_2$ targets contamined by controlled amounts of Gd and Sm.

33789 (CONF-800433—, pp 258-267) **Measurement of moisture depth distribution in composite materials using positron lifetime technique.** Singh, J.J. (NASA Langley Research Center, Hampton, VA); Holt, W.H.; Mock, W. Jr.; Mall, G.H. 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Fiber-reinforced resin matrix composites reportedly suffer significant degradation in their mechanical properties when exposed to hot, moist, environments for extended periods. Moisture weakens the fiber matrix bond as well as the matrix shear strength. An important factor in determining the extent of degradation is the depth distribution of moisture in the resin matrix. Despite the importance of measuring moisture distribution and its effects on composite material properties, not enough data are available on suitable nondestructive techniques for detecting and measuring moisture diffusion in organic composite materials. This paper addresses itself to the problem of measuring the moisture content of such materials, with special emphasis on its depth distribution, using positron lifetime technique.

33790 (CONF-800433—, pp 268-274) **Use of a synchrotron radiation x-ray microprobe for elemental analysis at the national synchrotron light source.** Gordon, B.M. (Brookhaven National Lab., Upton, NY). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The National Synchrotron Light Source (NSLS), due for completion at Brookhaven National Laboratory by the end of 1981, is a facility consisting of a 700 MeV and a 2.5 GeV electron storage ring and dedicated to providing synchrotron radiation in the energy range from the vacuum ultraviolet to high energy x rays. Some of the properties of synchrotron radiation that contribute to its usefulness for x-ray fluorescence are: a continuous, tunable energy spectrum, strong collimation in the horizontal plane, high polarization in the storage ring plane, and relatively low energy deposition. The highest priority is for the development of an x-ray microprobe beam line capable of trace analysis in the parts per million range with spatial resolution as low as one micrometer. An eventual capability for bulk sample analysis is also planned with sensitivities in the more favorable cases being as low as 50 parts per billion in dry biological tissue. The microprobe technique has application to a variety of fields including the geological, medical, materials and environmental sciences. Examples of investigations include multielemental trace analysis across grain boundaries for the study of diffusion and cooling processes in geological and materials sciences samples; i'lleukocytes and other types of individual cells for studying the relationship between trace element concentrations and disease or nutrition; and in individual particles in air pollution samples.

33791 (CONF-800433—, pp 275-285) **Laser isotope dating: a new technique of radioisotope dating using lasers.** McFarland, R.H.; Husain, J.; Schearer, L.D. (Univ. of Missouri, Rolla). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The selective detection of radioisotopes has important applications in many areas of science and technology including environmental and energy problems. At present the most sensitive technique of selective isotope detection is the one that is based on MeV range accelerators. In this paper we discuss some of the aspects of a recently introduced technique of selective isotope detection. We call it Laser Isotope Detection (L.I.D.) and show that L.I.D. sensitivities could be one or two orders of magnitude better than accelerator detection. We also present some ideas that may be useful for the enhancement of L.I.D. sensitivity.

33792 (CONF-800433—, pp 326-331) **Instrumental photon activation analysis of Cd and Pb in zinc ores, with a rotating device for intermittent irradiations.** Berthelot, C.; Carraro, G. (Central Bureau for Nuclear Measurements, Geel, Belgium). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The toxic elements in zinc ores: cadmium and lead, are determined precisely and non-destructively by photon activation using a rotating device for intermittent irradiations of the samples by the same gamma flux. The intact analysis is attractive as difficulties and errors associated with sample dissolution are eliminated. The determination of lead by photon activation is more appropriate than by thermal neutron activation, since in the latter case the cross section is extremely low and the $^{209}$Pb activation product is a pure $\beta^-$ emitter.

33793 (CONF-800433—, pp 470-479) **Biogeochemical prospecting for gold by neutron activation analysis.** Valente, I.M. (Univ. of London, Sunninghill, England); Minski, M.J.; Peterson, P.J. 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Shoot material of Chamaespartium tridentatum and Festuca ovina, collected together with soils from a rectangular pattern grid in an area in Spain, was analyzed for gold by instrumental neutron activation analysis. Values of gold were found to range from less than 1.0 x $10^{-3}$ $\mu g\ g^{-1}$(d.w.) at background sites to 65.4 x $10^{-3}$ $\mu g\ g^{-1}$ in the leaves of F. ovina in anomalous areas. The two plants studied were abundant on the site; they exhibited markedly different rooting patterns and they showed a degree of accumulation of gold in proportion to the concentration of the element in the soil. Seasonal variation in the gold concentration was noted. This work has emphasized the desirability of including plant analytical data in an evaluation of the mineral potential of a given area and should, in the case of gold, place mineral prospecting on an even sounder basis.

33794 **(EPRI-EA—1988) Proceedings: workshop on cycling and effects of toxic substances, Carmel, California, October 26-29, 1980.** Britt, D. (International Research and Technology Corp., McLean, VA (USA)). Aug 1981. 117p. NTIS, PC A06/MF A01. Order Number DE81904201.

The purpose of the workshop was to suggest a research program responsive to the needs of the electric utility industry and designed to assess the cycling and effects of toxic substances in ecological systems. The workshop participants recommended a broad, conceptual framework for the development of a Toxic Substances Subprogram within the Ecological Studies Program. Futhermore, several guiding principals were suggeted for the proposed Subprogram, and a variety of specific research areas was identified and ranked for future implementation by EPRI.

## 5103 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 33001, 33035, 33048, 33049, 33050, 33051, 33361, 33767, 33828, 33903*

33795 **(BNL—29762) Microbial transformation of low-level radioactive waste.** Francis, A.J. (Brookhaven National Lab., Upton, NY (USA)). Jun 1980. Contract AC02-76CH00016. 18p. (CONF-810722—8). NTIS, PC A02/MF A01. Order Number DE81025870.

From International symposium on migration in the terrestrial environment of long-lived radionuclides from the nuclear fuel cycle; Knoxville, TN, USA (27 Jul 1981).

Microorganisms play a significant role in the transformation of the radioactive waste and waste forms disposed of at shallow-land burial sites. Microbial degradation products of organic wastes may influence the transport of buried radionuclides by leaching, solubilization, and formation of organoradionuclide complexes. The ability of indigenous microflora of the radioactive waste to degrade the organic compounds under aerobic and anaerobic conditions was examined. Leachate samples were extracted with methylene chloried and analyzed for organic compounds by gas chromatography and mass spectrometry. In general, several of the organic compounds in the leachates were degraded under aerobic conditions. Under anaerobic conditions, the degradation of the organics was very slow, and changes in concentrations of several acidic compounds were observed. Several low-molecular-weight organic acids are formed by breakdown of complex organic materials and are further metabolized by microorganisms; hence these compounds are in a dynamic state, being both synthesized and destroyed. Tributyl phosphate, a compound used in the extraction of metal ions from solutions of reactor products, was not degraded under anaerobic conditions.

33796 (CONF-800433—, pp 135-146) **Model for Pb-210 in sediments influenced by mixing and compaction.** Christensen, E.R.; Chien, N.K. (Univ. of Wisconsin, Milwaukee). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

A unified model for the activity of radionuclides in sediments has been set up based on the one-dimensional advection-diffusion equation. The model considers sedimentation, mixing and compaction. Observed distributions of deposit-feeding organisms, and the nature of physical disturbances, indicate that a Gaussian diffusion coefficient may be appropriate. Two-layer models with constant and Gaussian mixing, respectively, in the upper layer are compared with measured Pb-210 profiles for two cores from Green Bay, Lake Michigan, and it is found that the maximal diffusion coefficient $D_0$ = 4 $cm^2/yr$ for the Gaussian model is considerably greater than the constant D value of 0.2 $cm^2/yr$, if compaction effects are neglected. The solution for the Gaussian model is based on an approximate power series method. Compaction can be taken into account using an exponential sedimentation rate or sediment density. By comparing with measured data for a Lake Ontario core it is seen that compaction alone can give an appreciable flattening of the activity curves near the top layers. An exponential sedimentation rate tends to overestimate this flattening, while it is slightly underestimated using an exponential sediment density.

33797 (CONF-800433—, pp 321-325) **Microautoradiography: a useful technique for investigating radionuclide transport in geologic media.** Thompson, J.L. (Idaho State Univ., Pocatello); Daniels, W.R.; Maestas, S.; Vine, E.N.; Wolfsberg, K. 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Microautoradiographic techniques have been found to be useful in studies related to the behavior of uranium and transuranics as groundwater solutions in contact with geologic media. Microscopic examination of the alpha particle tracks generated in emulsions by these radionuclides has given insight into the flow patterns of the solutions through rock, allowed the identification of minerals responsible for radionuclide sorption, and identified the tendency of

some radioactive species to form aggregates in the aqueous phase. Preparation of the autoradiograms requires only modest amounts of the radionuclide, times of a few days, and relatively simple equipment. Microautoradiography provides information difficult to obtain by other means and is an important supplement to conventional techniques employed to study radionuclide sorption and transport.

33798 (CONF-800433—, pp 524-533) **In situ determination of transuranic and fission product radionuclides.** Kay, M.A. (Rockwell International, Richland, WA). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Waste management requires radionuclide inventory and distribution data as input to the decision-making process for ultimate disposal of the wastes. If field operations such as earthmoving are required, prompt onsite radioassay capability is necessary to differentiate between contaminated and uncontaminated earth. To fulfill these requirements, two development vans (Dev Van I and II) have been designed, built, equipped, and field tested on the Hanford Site. Dev Van I is a surface layer radioactivity assay system, and Dev Van II is a borehole, well or drillhole (a well extends to the groundwater), radioactivity assay system. Both Dev Vans are equipped for solid state x-ray or gamma-ray spectrometry. The Dev Vans will be described and the results of field tests presented. Problems encountered during field testing and the solutions to be implemented will be discussed.

33799 (CONF-800433—, pp 560-569) **Determination of $^{210}$Pb and $^{210}$Po in the environment.** Raines, W.L.; Dillard, J.W.; Kanipe, L.G.; Hobbs, B.B. (Tennessee Valley Authority, Muscle Shoals, AL). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Measurement of $^{210}$Po and $^{210}$Pb in environmental samples is a vital part of environmental monitoring programs for regions where uranium is mined or processed. A method for determination of these isotopes in environmental samples is discussed. The key to the procedure is the parent-daughter relationship between $^{210}$Pb and $^{210}$Po. Lead carrier is added and subsequent formation of several lead compounds is the basis for separation and purification. The $^{210}$Po activity is determined by alpha spectroscopy after polonium is plated on a nickel disc. The plating technique uses a rotating disc electrode to ensure uniform plates and to reduce plating time substantially. A tracer of $^{209}$Po is used to quantitate the plating and alpha counting process. The $^{210}$Pb activity is determined from the activity of the daughter $^{210}$Po after a 30-day ingrowth period. The measured activity of $^{210}$Pb is corrected for the lead chemical yield using a three-point standard addition and anodic stripping voltametry.

33800 (CONF-800433—, pp 705-717) **On-line monitoring of Plutonium in mixed Uranium-Plutonium solutions.** Hofstetter, K.J.; Rebagay, T.V.; Huff, G.A. (Allied-General Nuclear Services, Barnwell, SC). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The measurement of the total and isotopic plutonium concentrations in mixed uranium-plutonium solutions blended with highly radioactive fission product nuclides and other radionuclides has been investigated at the Barnwell Nuclear Fuel Plant (BNFP). An on-line total and isotopic plutonium monitoring system is being tested for its ability to assay the plutonium abundances in solutions as might be found in the process streams of a light water reactor (LWR) spent fuel processing plant. The monitoring system is fully automated and designed to be maintained remotely. It is capable of near real-time inventory of plutonium in process streams and provides the basis for on-line computerized accounting of special nuclear materials.

33801 **(DPSPU—81-30-1) Environmental monitoring in the vicinity of the Savannah River Plant. Annual report, 1980.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1980. Contract AC09-76SR00001. 70p. NTIS, PC A04/MF A01. Order Number DE81030366.

An extensive surveillance program has been continuously maintained since 1951 to determine the concentrations of radonuclides in a 1200-square-mile area in the environs of the plant and the radiation exposure of the population resulting from SRP operations. The results of this monitoring program are reported annually to the public. This document summarizes the 1980 results. The radiation dose at the plant perimeter and the population dose in the region from SRP operations is very small relative to the dose received from naturally occurring radiation. The annual average dose in 1980 from atmospheric releases of radioactive materials from SRP was 0.7 millirem at the plant perimeter. The maximum dose at the plant perimeter was 1.01 mrem, which is 0.2% of the Department of Energy limit for offsite exposures. The population dose to people living within 80 km of the center of SRP was 99.7 man-rems. During 1980, this same population received a radiation dose of 54,400 man-rems from natural radiation and an additional dose of 47,000 man-rems from medical x-rays. An individual consuming river water downstream from SRP would receive a maximum calculated dose in 1980 of 0.22 mrem which includes dose contributions from consumer products produced using Savannah River water. Air and water are the major dispersal media for radioactive emissions. Samples representing most segments of the environment that may conceivably be affected by these emissions were monitored to ensure a safe environment. Releases of radioactivity from SRP had an inconsequential effect on living plants and animals. With a few exceptions, concentrations outside the plant boundary were too low to distinguish from the natural radioactive background and continuing worldwide fallout from nuclear weapons tests. (JGB)

33802 **(EPA/600—4-81-047) Offsite environmental monitoring report. Radiation monitoring around United States nuclear test areas, calendar year 1980.** Smith, D.D.; Grossman, R.F.; Corkern, W.D.; Thome, D.J.; Patzer, R.G.; Hopper, J.L. (Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.). Jun 1981. Contract AI08-76DP00539. 113p. (DOE/DP/00539—043). NTIS, PC A06/MF A01. Order Number DE81030214.

The US Environmental Protection Agency's (EPA) Environmental Monitoring Systems Laboratory in Las Vegas (EMSL-LV) continued its Offsite Radiological Safety Program for the Nevada Test Site (NTS) and other sites of past underground nuclear tests. For each test, the Laboratory provided airborne meteorological measurements, ground and airborne radiation monitoring teams, and special briefings to the Test Controller's Advisory Panel. Test-related radioactivity from the NTS was detected offsite following the Riola Test conducted on September 25, 1980. This consisted of xenon-133 ($3.4 \times 10^{-11}$ $\mu$Ci/ml) and xenon-135 ($3.6 \times 10^{-10}$ $\mu$Ci/ml) in a compressed air sample collected at Lathrop Wells, Nevada. The estimated dose equivalent to the whole body of a hypothetical receptor at Lathrop Wells from exposure to the radioxenon was 0.011 mrem, which is 0.006 percent of the radiation protection guide for a suitable sample of the general population. Whole-body counts of individuals residing in the environs of the NTS showed no manmade radionuclides attributable to the testing program. The only radioactivity from non-NTS sites of past underground nuclear tests was due to tritium in water samples collected from the Project Dribble Site near Hattiesburg, Mississippi, and the Project Long Shot Site on Amchitka Island, Alaska. The maximum concentrations measured at these locations were 1 and 0.1 percent of the Concentration Guide for drinking water, respectively. A small amount of airborne radioactivity originating from nuclear tests carried out by the People's Republic of China was detected during 1980 at some stations scattered throughout the Air Surveillance Network. The Laboratory's Animal Investigation Program sampled tissues from wildlife and domestic animals on and around the NTS. Data from analysis of these tissues are published separately in an annual report.

33803 **(ORNL/TM—7858) Environmental radiological survey of the intermediate-level waste system pipeline.** Ohnesorge, W.F.; Oakes, T.W.; Parsons, D.W.; Malone, J.L. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 45p. NTIS, PC A03/MF A01. Order Number DE81030625.

This publication gives the results of a February 1979 radiation survey of the intermediate-level waste system pipeline. Survey techniques and recommendations for health physics monitoring during cleanup are included.

33804 **(PNL—3616) Unsaturated moisture and radionuclide transport: laboratory analysis and modeling.** Gee, G.W.; Campbell, A.C.; Wierenga, P.J.; Jones, T.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1981. Contract AT06-76RL01830. 44p. NTIS, PC A03/MF A01. Order Number DE81029397.

This report describes several laboratory procedures and computer model simulations used to evaluate the transport of water and radionuclides through unsaturated Hanford soils. The unsaturated hydraulic conductivity was measured using the steady state methods of Klute and the transient state method of Rose. These experimental data were compared to other conductivity models. Good agreement was found between all methods in the wet range; however, disagreement was found in the dry range. None of the conductivity models explicity addresses the water vapor component of the conductivity. This may explain the under prediction of the hydraulic conductivity in the dry range where vapor transport is important. Radionuclide transport through unsaturated media was investigated by using two solute transport models to describe the transport of tritium and strontium-85 in laboratory columns. A two parameter convective-dispersive model was compared with a four parameter mobile-immobile water model. Both models adequately described the movement of tritium and strontium through small (5 cm x 27.5 cm) columns and the movement of tritium and strontium through a large (0.5 m x 1.7) column. The dispersion coefficient was found to be sensitive to changes in both velocity and column length. The mobile-immoble water equations were not as sensitive to changes in experimental scales as the convective-dispersive equation. Both models were relatively successful in describing the rapid flush of strontium-85 from a column initially leached with a low salt solution followed by a high salt solution, a phenomona called the snow plow effect. The four parameter mobile-immobile water model predicted the initial release of the strontium more accurately than the two parameter convective-dispersive model. Both models confirm enhanced mobility of strontium-85 with leaching solutions of increased salt concentration.

33805 **(UCRL—53152-Pt.1) Results of calculations of external gamma-radiation exposure rates from fallout and the related radionuclide compositions. Operation Ranger, 1951.** Hicks, H.G. (Lawrence Livermore National Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 63p. NTIS, PC A04/MF A01. Order Number DE81030467.

This report presents data on calculated gamma radiation exposure rates and ground deposition of related radionuclides resulting from Events that deposited detectable radioactivity outside the Nevada Test Site complex.

## 5105 Site Resource And Use Studies

*REFER ALSO TO CITATION(S) 32880, 32881, 32882, 32883, 32884, 32885, 32886, 32887, 32888, 32889, 32890, 32892, 32956, 32957, 32958, 33024, 33025, 33026, 33027*

33806 (CONF-800433—, pp 181-194) **Use of neutron-capture prompt gamma-ray activation analysis in environmental and energy research.** Gordon, G.E. (Univ. of Maryland, College Park). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Reactor-based neutron-capture prompt γ-ray activation analysis (PGAA) can be used for several trace elements (e.g., B, Cd, Sm, Gd), but it is mainly a major and minor element method. Among the 15 to 20 elements that can be determined in a particular type of sample, the major elements C, H, N and S can usually be measured in coals and biological samples and the elements of geochemical interest, Na, Al, Si, K, Ca, Ti, Fe and others in rocks, coal and other crustal samples. When used along with instrumental neutron activation analysis (INAA), the combined techniques can be used to analyze for 40 to 50 elements in crustal samples. Suggestions for further development of reactor-based PGAA include: the need to reduce low-energy γ-ray backgrounds for observations of species having intense lines only at low energy, more development of biological and special materials applications, the use of beam choppers to look for very short-lived species, and demonstrations of analyses of samples too large, precious or hazardous to be irradiated inside reactors. The greatest potential for applications of PGAA may be in the use of systems detached from reactors, i.e., those using $^{252}Cf$ or other isotopic neutron sources. This may be the only method for elemental analyses of large, inhomogeneous process streams in various industries, power plants, etc. Fluxes comparable to those of external beams from reactors are feasible with the use of mg quantitites of $^{252}Cf$. Practical systems for use on coal have been developed. Many other applications would be possible: field prospecting for valuable ore deposits, studies of nutrients in soil and plants, in situ measurements in remote locations such as planetary surfaces, mines, bore holes, etc.

33807 **(DOE/SR/10018—5) Guide to Douglas Point, Charles County, Maryland.** Jensen, B.L.; Miles, K.J.; Strass, P.K.; McDonald, B.S. Jr. (Charles County Community Coll., La Plata, MD (USA)). 1980. Contract AS09-79SR10018. 118p. NTIS, PC A06/MF A01. Order Number DE81028078.

In 1974, the tract of land now known as the Douglas Point Ecology Laboratory was pieced together from approximately 10 smaller pieces by the Potomac Electric Power Company (PEPCO) for the purpose of developing a nuclear power generating station. At that time they decided to leave the bulk of the property in its natural state for ecological research. Douglas Point is reasonably representative of a large section of the Atlantic Coastal plain. Results from research on the site may be applicable to larger coastal plain areas. This section of Charles County is one of the least populated areas in Maryland, and the portion of the county known as Maryland Point, which includes Douglas Point, contains some of the most extensive, continuous forested tracts of land remaining in the state. The present publication is intended to be used as an introduction to Douglas Point, its history, biology, geology, topography, soils, and climatology.

## 5106 Regulations

*REFER ALSO TO CITATION(S) 32955*

33808 (DOE/EP/10012—1, pp 80-92) **Land resources.** Jun 1981. NTIS, PC A06/MF A01.

In Energy and environmental quality: case histories of impact management.

Regulations concerning land use and energy source developments are expressed. Current trends in land leasing and surface mining controls are reviewed in a case studies discussion. (DLS)

# 52 ENVIRONMENTAL SCIENCES, AQUATIC

## 5201 Basic Studies

*REFER ALSO TO CITATION(S) 33015, 33772, 33773, 33774, 33821*

33809 **(BNL—51396) Water analysis methods at the integrated Lake Watershed Acidification Study Laboratory, Raquette Lake, NY.** Tokos, J. (Brookhaven National Lab., Upton, NY (USA)). Sep 1980. Contract AC02-76CH00016. 17p. NTIS, PC A02/MF A01. Order Number DE81030148.

The materials, equipment, and methods used by Brookhaven National Laboratory personnel for routine chemical and biological analyses in the three lakes of the Integrated Lake Watershed Acidification Study are described. The procedures apply to pelagic sam-

ples taken from Panther, Sagamore, and Woods Lakes. Separate sections outlining benthic primary production and inlet-outlet methods are included.

33810 (CONF-800433—, pp 119-126) **Non-destructive multi-element photon activation analysis of river sediments.** Berthelot, C.; Carraro, G.; Verdingh, V. (Central Bureau for Nuclear Measurements, Geel, Belgium). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

An instrumental photon activation analysis method has been developed for the determination of multi-element concentrations in Scheldt and National Bureau of Standards (NBS) river sediments. The intact analysis of a complex matrix, such as the sediment, is attractive as difficulties and errors associated with sample dissolution, are eliminated. The absorption of high energy photons by the sediments, composed mainly of low-Z elements, is small and the bulk sample can be activated homogeneously. A large number of toxic elements, including the actinides Th and U at low levels, have been determined nondestructively by photo activation.

33811 **Scientific, technological and institutional aspects of water resource policy.** Haimes, Y.Y. (ed.). Boulder, Colorado; Westview Press, Inc. (1979). 142p. (CONF-790122—).

From Annual meeting of the American Association for the Advancement of Science; Houston, TX, USA (3 Jan 1979).

The volume addresses water policy issues related to water resources research, ground water, water conservation, urban water systems, water resource planning, supply and demand interaction, principles and standards, and cost-benefit analysis, as well as general, institutional aspects of local, state, regional, and federal policies. The five contributors are scientists with expertise in water resources policy; their associations with Congress, the administration, state and local governments, private industry, and the academic community provide broad perspectives of their subject.

## 5202 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 32842, 32869, 33730, 33731, 33732, 33733, 33734, 33735, 33736, 33746, 33764, 33784, 33785, 33787, 33790, 33794, 33801, 33809, 33911, 33915*

33812 (CONF-800433—, pp 106-118) **Neutron activation analysis in the survey of river water quality and trace element distribution.** Ganzerli Valentini, M.T. (Laboratorio di Radiochimica e Centro di Radiochimica e Analisi per Attivazione del CNR, Pavia, Italy); Genova, N.; Maggi, L.; Meloni, S.; Stella, R.; Albini, A.; Salghetti, F. 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Neutron Activation Analysis has been employed to characterize river water samples, either with instrumental analysis (INAA) or after simple radiochemical separations (for Hg, Cd and Cu), within a study on the dispersion of inorganic pollutants in water systems. In particular, five grain-size fractions of suspended particulate matter have been analyzed by this technique while Atomic Absorption has been used for the aqueous phase (filtered through 0.45 $\mu$m) in equilibrium.

33813 (CONF-800433—, pp 147-158) **Element analysis by PIXE of environmental samples of the Brazilian Cerrado.** Paschoa, A.S.; Baptista, G.B.; Montenegro, E.C.; Barros Leite, C.V.; Cullen, T.L. (Pontificia Univ. Catolica do Rio de Janeiro, Brasil). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

A vast region in the Brazilian central plateau is characterized by a flora denominated Cerrado and a somewhat peculiar fauna. An area of about 13 km$^2$ in this region is maintained as an ecological reserve. A number of scientists, including biologists, chemists, geologists, botanists and physicists are involved in several research projects in this ecological reserve. The present paper deals only with the contribution to the study of soil and particulate matter suspended in natural springs and rainwater of the area, by using the PIXE technique as an analytical tool to determine the metal concentrations in these materials. The concentrations of titanium, zinc, chromium, copper and calcium in relation to iron have been determined in samples of soil and suspended materials in springwater to serve as a basis for future comparisons with similar samples from several origins. Variations in the concentrations of potassium, calcium, titanium, chromium, nickel, copper and zinc in relation to iron have been monitored in the suspended matter found in rainwater collected within the area.

33814 (CONF-800433—, pp 169-174) **Study of heavy elements (Cd, Hg and Se) in the aquatic environment around Bombay by radiochemical neutron activation analysis.** Ganesan, R.; Shah, P.K.; Turel, Z.R.; Haldar, B.C. (Environmental Chemistry Lab., Bombay, India). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Hg, Cd and Se in water, sediment and tissues of crabs collected from five locations around Bombay have been measured by radiochemical neutron activation analysis. The results are discussed to throw light on the heavy metal contamination of the aquatic environment.

33815 (CONF-800433—, pp 313-320) **Ultra-sensitive trace element analysis of environmental samples using advanced TRXRF techniques.** Schwenke, H.; Knoth, J.; Michaelis, W. (GKSS-Forschungszentrum, Geesthacht, Germany). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

X-ray fluorescence analysis is a widely adopted technique for measuring elemental concentrations in a variety of sample species. The particular advantages compared to other methods are simplicity in instrumentation, rapidity of measurement and the high degree of automation attainable. In trace element analysis, however, the sensitivity of conventional x-ray fluorescence analysis is often insufficient. The paper describes a new type of energy-dispersive equipment which reveals ultimate performance with respect to detection limits and which thus considerably extends the applicability of XRF analysis. The essential feature of the system is the utilization of multiple total reflection (TR) of the exciting x-ray beam from polished quartz glass surfaces. Since the refractive index is slightly smaller than 1, total reflection occurs if the radiation strikes the surface at angles of less than 5'. The grazing incident beam from a fine-structure x-ray tube is twice reflected and follows a zigzag path before it is directed to the sample prepared as a thin film on the third quartz glass surface. The direct beam and scattered radiation are eliminated by diaphragms. In this way, a further reduction of the background in the fluorescence spectrum is achieved compared to a previously published version with single reflection of the exciting beam. The performance of the instrument leads to detection limits for aqueous solutions below $10^{-11}$ g or 0.1 ppB, respectively, for at least 20 elements.

33816 (CONF-800433—, pp 636-644) **Studies of Oxygen and Nitrogen in coal conversion liquids by 14 MeV INAA.** Khalil, S.R.; Koppenaal, D.W.; Ehmann, W.D. (Univ. of Kentucky, Lexington). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Fast neutron activation analysis has been used for the direct determination of oxygen and nitrogen in coal conversion liquids. The technique is based on the $^{16}O(n,p)^{16}N$ and $^{14}N(n,2n)^{13}N$ reactions induced by 14 MeV neutrons produced by a Cockcroft-Walton neutron generator. Multiscaler counting of the 6.13 and 7.12 MeV $^{16}N$ photopeaks is used for the oxygen analyses. The detection system consists of two 7.6 x 7.6 cm NaI(T1) scintillation detectors, mounted at 180$^0$ and connected to a summing amplifier. The samples are rotated uniaxially in both the irradiation and counting positions. Multiscaler coincidence counting of 0.511 MeV

annhilation photons from the positron decay of $^{13}N$ is used for the nitrogen analyses. Oxygen and nitrogen contents in coals and coal conversion liquids are highly variable. Differences in gamma-ray self-absorption of the low average atomic number organic matrix in coal liquids and the higher average atomic number USGS BCR-1 and NBS $K_2Cr_2O_7$ oxygen standards normally used for oxygen determinations in geochemical matrices have been observed. Therefore, two separate sets of organic liquids were selected and evaluated for use as oxygen or nitrogen standards in the analyses of coal-derived liquids. Dilutions with n-hexane, or mixtures of two compounds from the selected liquid standard sets make it possible, if desired, to fine tune oxygen and nitrogen levels in the standards to values corresponding to those anticipated in the coal conversion liquids being studied. The standard liquids are selected using criteria of high boiling point, high purity, consistent stoichiometry, a non-hygroscopic nature, and simple CHO or CHN elemental composition. Possible interferences from recoil proton reactions on carbon and oxygen are considered for the nitrogen determinations.

33817 (CONF-800433—, pp 662-670) **Radiochemical-NAA studies of biological samples in connection with marine production of petroleum.** de Lancey, K.; Guinn, V.P. (Univ. of California, Irvine). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

A previous NAA radiochemical-separation procedure for Ba-139 has been modified to also recover Sr-87m quantitatively (precipitated together as the sulfates), and, via extraction with a chloroform solution of $Bi(DDC)_3$, to recover Cu and Hg. After removal of Na-24 from the aqueous phase with HAP, other activities, such as Zn-69m, can be measured in it.

33818 (CONF-800433—, pp 729-741) **Approach to Cadmium speciation in natural waters using $^{109}Cd$ as radiotracer.** Maggi, L.; Caramella-Crespi, V.; Genova, N.; Meloni, S. (Univ. di Pavia, Italy). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The present study was undertaken to evaluate to which extent cadmium present in natural waters is associated to organic matter and/or to large inorganic molecules and suspended particulate, whose size is below 0.45 $\mu$m. Cadmium behavior was investigated by adding to the original waters carrier-free $^{109}Cd$ as a tracer. A simpler approach to the identification and, possibly, characterization of organic and large inorganic species of cadmium was established by fractionating inorganic and organic matter in natural waters (Po and Lambro rivers in Northern Italy) with the ultrafiltration technique. Cadmium content and distribution were correlated to organic carbon content, inorganic and organic phosphorous content and to soluble silica concentration. A preliminary evaluation of the strength of ligands in the water fractions was obtained by batch and column experiments with Chelex resins. Results, behaviors and trends are reported and discussed.

33819 (CONF-800433—, pp 742-752) **Soil homogeneity evaluation by radionuclide tracer breakthrough curve interpretation.** Brenizer, J.S. Jr.; Jarrett, A.R.; Jester, W.A. (Pennsylvania State Univ., University Park). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Increasing concern about the environmental impact of hazardous waste disposal has made site evaluation and site selection difficult and expensive. Pollutants, assumed to be absorbed by the soil immediately surrounding the burial trench, have been detected far from sites. Discrepancies between predicted migration distances based on indirect methods such as laboratory and computer modeling and those observed at the field site are often significant. The homogeneity of subsurface media, often assumed in laboratory and modeling studies, is seldom found in the field. The use of tracers to determine the flow characteristics of a potential disposal site involves time and expense, but offers a direct evaluation of solute transport and eliminates the assumptions inherent in indirect methods. Current modeling of solute transport in nonhomogeneous porous media is limited by the quantification of input parameters. Several general models can predict solute transport in saturated-unsaturated media from low-level disposal sites if the hydraulic characteristics and chemical reactions expected in each unique water-solute-media system can be defined. The objective of this research was to develop a method of evaluating potential shallow-land burial waste disposal sites by interpreting tracer breakthrough curve structure with respect to the hydrologic properties of the media at the potential disposal site. This methodology will be helpful in evaluating the potential performance of many types of shallow-land waste burial sites such as low-level radioactive waste disposal, surface disposal of flyash, chemical waste disposal, waste sedimentation ponds, and sanitary landfills.

33820 (DOE/EV/70024—44) **Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981.** Carpenter, R. (comp.). (Washington Univ., Seattle (USA). Dept. of Oceanography). Jul 1981. Contract AT06-76EV70024. 14p. NTIS, PC A02/MF A01. Order Number DE81030319.

This report summarizes progress from September 1980 through July 1981 on a series of marine chemical and geochemical investigations involving both laboratory studies and field studies off the coast of Washington. Most of the field work has been on the Washington continental shelf, slope, and the submarine canyons indenting the shelf north of the Columbia River. The aim is to provide basic data required to characterize underlying chemical and physical processes and their rates which control the distributions, concentrations, and ultimate fate of some of the potentially hazardous agents associated with fossil fuel and/or nuclear power production or transportation. We are concentrating on several processes which we feel are of special importance in the sea, and developing methodologies and expertise to study them. Laboratory and field experiments and theories derived from them are being used iteratively to investigate: (1) vertical transfer of trace chemicals from surface seawaters to underlying waters and sediments; (2) processes which may transfer certain chemicals from sediments back into the overlying water column; (3) redox processes which besides changing valence states of certain chemicals may alter their precipitation/dissolution tendencies, their biological availability and/or toxicity; and (4) accumulation histories of potentially hazardous chemicals in sediments during the past 100 years.

33821 (EPRI-EA—1989) **Assessment of optimum aquatic microcosm design for pollution impact studies.** Harte, J.; Levy, D.; Rees, J.; Saegebarth, E. (Lawrence Berkeley Lab., CA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Aug 1981. Contract W-7405-ENG-48. 179p. NTIS, PC A09/MF A01. Order Number DE81030674.

A series of experiments was carried out to evaluate optimum design and operating conditions for pelagic lake microcosms and to explore a possible use of such systems for toxicological testing. Criteria selected for microcosm optimization were realism and replicability of identically initiated microcosms. In the assessment studies, a number of different pelagic microcosm configurations were studied, including the size of the microcosm containers, the method of algal surface-growth prevention, and the degree of water mixing and aeration. In addition, the microcosm-lake comparisons were carried out in various seasons of the years to determine the influence of natural seasonal factors on the chemical and biological differences between the lakes and microcosms. In all but the smallest microcosms, surface-growth prevention removed size dependence. Chemical nutrients tracked well except during periods when nutrient inputs to the lake from the surrounding watershed were high. Good tracking of phytoplankton succession patterns was observed only when the physical conditions of the lake matched well with those in the laboratory system. In the decomposition studies, additions of dead organic matter to the lake microcosms were made, and the subsequent response of mineralization activity was measured. Highly replicable and interesting short-term behavior was seen, implying that protocols can be developed for microcosm testing of effects of toxicants on mineralization rates. On the basis of the microcosm assessment and decomposition studies, it was concluded that appropriate applications of pelagic microcosms are limited, and those applications that are most appropriate are delineated.

33822 (LBL—11986, pp 5.47-5.50) **Acid precipitation damage to aquatic ecosystems.** Harte, J.; Tonnessen, K.; Schneider, R.; Lockett, G.; Oldfather, J. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

Two research efforts to study acid precipitation effects in high-elevation aquatic ecosystems are underway at Lawrence Berkeley Laboratory (LBL). One goal of this research is to establish baseline conditions against which changes can be detected should they occur. A second and related goal is to develop from the pattern of such changes and from associated laboratory studies an increased understanding of the mechanisms and progression of acidification and its impacts on high-elevation aquatic ecosystems.

## 5203 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 33048, 33049, 33052, 33053, 33767, 33797, 33799, 33801, 33802, 33820, 33888, 33928*

33823 (CONF-800433—, pp 45-53) **Environmental radionuclide concentrations: statistical model to determine uniformity of distribution.** Cawley, C.N. (Cornell Univ., Ithaca, NY); Fenyves, E.J.; Spitzberg, D.B.; Wiorkowski, J.; Chehroudi, M.T. 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

In the evaluation of data from environmental sampling and measurement, a basic question is whether the radionuclide (or pollutant) is distributed uniformly. Since physical measurements have associated errors, it is inappropriate to consider the measurements alone in this determination. Hence, a statistical model has been developed. It consists of a weighted analysis of variance with subsequent t-tests between weighted and independent means. A computer program to perform the calculations is included.

33824 (CONF-800433—, pp 540-548) **Autoradiographic studies of actinide sorption in groundwater systems.** O'Kelley, G.D.; Beall, G.W.; Allard, B. (Oak Ridge National Lab., TN). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Autoradiography is a convenient and sensitive technique for the study of spatial distributions of alpha radioactive nuclides on slabs of rock or on other planar surfaces. The autoradiographic camera contains an arrangement for placing in firm contact Polaroid sheet film, a plastic scintillator screen, and the radioactive face of the specimen. As an example of the use of the autoradiographic method, a series of sorption experiments were carried out in which synthetic groundwater solutions of americium, neptunium, uranium, and plutonium were contacted with Climax Stock granite under aerated and anoxic conditions at pH 8 to 9. The sorption observed at specific mineral sites was correlated with data on sorption of these actinides on pure minerals.

33825 (CONF-800433—, pp 571-586) **Development of novel radiochromatographic techniques for investigation of trace element behavior in coal liquefaction.** Filby, R.H.; Das Gupta, A.K.; Barbee, D.D. (Washington State Univ., Pullman). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

A Ge(Li) detector and ND 6620 gamma-ray spectrometer system have been coupled to a liquid chromatograph to provide on-line continuous monitoring of radionuclides in the chromatographic effluent. The high resolution of the Ge(Li) detector allows the simultaneous detection and measurement of radionuclides eluting simultaneously from the LC column. The technique has been applied to the separation and determination of $^{65}$Ni, $^{60}$Co, $^{64}$Cu, /sup 69m/Zn, and $^{56}$Mn by anion exchange on DOWEX 1 in HCl solutions, to the separation of metal chelates on $SiO_2$, and to the separation of short-lived radionuclides, /sup 60m/Co, $^{52}$V, $^{27}$Mg, and $^{66}$Cu on anion exchanger.

33826 (CONF-800433—, pp 719-728) **Plutonium as a tracer for studies of settling processes in a slow body of running water.** Pimpl, M.; Schuettelkopf, H. (Kernforschungszentrum, Karlsruhe, Germany). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The mechanism of plutonium settling in a slow body of running water was investigated by the example of plutonium activity released from the Karlsruhe Nuclear Research Center into the Altrhein, an old branch of the river Rhine. It was found that the plutonium distribution in the sediments depends on the distance of the location under consideration from the point of discharge and the sediment density which, in turn, is influenced by the width of the Altrhein and hence by the flow velocity. In the topmost sediment layers over the first 3.5 km an isotope ratio Pu-238/P-239+240 of 0.64 was found, in the bottom layers a ratio of 0.36. It is supposed that the contamination of the bottom layers is caused by sinking in of the oldest plutonium contamination in a highly liquid sediment, whilst the topmost layer is characterized by the plutonium emission of the recent years. The plutonium concentration is equally distributed over the depth. Shortly after the point of discharge water and filterable suspended matter show an increased plutonium contamination although the plutonium content quickly decreases with increasing distance from the point of discharge and reaches the reference value already after 3.5 km, this value being determined in samples from the same water upstream of the point of discharge. The total amount of plutonium deposited in the main canal was estimated from the sediment contaminations and the amounts of sediment. In the sediments located below the water surface 94% of the plutonium, which have been released from the Nuclear Research Center into the Altrhein, was found again. This means that the majority of plutonium emitted together with the liquid effluents is still present in the Altrhein. This proves that resuspension in plutonium transport in the Altrhein plays but a minor role.

33827 (DOE/EV/10251—3) **Biogeochemical studies of technetium in marine and estuarine ecosystems. Progress report, 1 July 1980-31 July 1981.** Beasley, T.M. (Oregon State Univ., Newport (USA). Marine Science Center). 1981. Contract AM06-76RL02227. 76p. NTIS, PC A05/MF A01. Order Number DE81030325.

This report summarizes progress from July 1980 through July 1981 on studies dealing with the biogeochemical behavior of technetium in marine and estuarine ecosystems. While the duration of the research has been slightly over two years, the results of our experiments have substantially extended our understanding of the environmental behavior of Tc (principally as $TcO^-_4$).

33828 (UCRL—52853-Pt.1) **Northern Marshall Islands radiological survey: sampling and analysis summary.** Robison, W.L.; Conrado, C.L.; Eagle, R.J.; Stuart, M.L. (Lawrence Livermore National Lab., CA (USA)). 23 Jul 1981. Contract W-7405-ENG-48. 102p. NTIS, PC A06/MF A01. Order Number DE81029429.

A radiological survey was conducted in the Northern Marshall Islands to document reamining external gamma exposures from nuclear tests conducted at Enewetak and Bikini Atolls. An additional program was later included to obtain terrestrial and marine samples for radiological dose assessment for current or potential atoll inhabitants. This report is the first of a series summarizing the results from the terrestrial and marine surveys. The sample collection and processing procedures and the general survey methodology are discussed; a summary of the collected samples and radionuclide analyses is presented. Over 5400 samples were collected from the 12 atolls and 2 islands and prepared for analysis including 3093 soil, 961 vegetation, 153 animal, 965 fish composite samples (average of 30 fish per sample), 101 clam, 50 lagoon water, 15 cistern water, 17 groundwater, and 85 lagoon sediment samples. A complete breakdown by sample type, atoll, and island is given here. The total number of analyses by radionuclide are 8840 for $^{241}$Am, 6569 for $^{137}$Cs, 4535 for $^{239+240}$Pu, 4431 for $^{90}$Sr, 1146 for $^{238}$Pu, 269 for $^{241}$Pu, and 114 each for $^{239}$Pu and $^{240}$Pu. A complete breakdown by sample category, atoll or island, and radionuclide is also included.

33829 **(UCRL—53853-Pt.3) Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway.** Robison, W.L.; Noshkin, V.E.; Phillips, W.A.; Eagle, R.J. (Lawrence Livermore National Lab., CA (USA)). 18 Aug 1981. Contract W-7405-ENG-48. 36p. NTIS, PC A03/MF A01. Order Number DE81030471.

The survey consisted, in part, of an aerial radiological reconnaissance to map the external gamma-ray exposure rates. As a secondary phase, terrestrial and marine samples were collected to assess the radiological dose from pertinent food chains to atoll inhabitants. The marine sample collection, processing, and dose assessment methodology are presented as well as the concentration data for $^{90}Sr$, $^{137}Cs$, $^{238}Pu$, $^{239+240}Pu$, $^{241}Am$, and any of the other gamma emitters in fish and clam muscle tissue from the different species collected. Doses are calculated from the average radionuclide concentrations in fish and clam muscle tissue assuming an average daily intake of 200 and 10 g, respectivelty. The $^{90}Sr$ concentration in muscle tissue is very low and there is little difference in the average concentrations from the different fish from different atolls or islands. The $^{239+240}Pu$ concentration in the muscle tissue of all reef species, however, is higher than that in pelagic lagoon fish. In contrast, $^{137}Cs$ concentrations are lowest in the muscle tissue of the bottom-feeding reef species and highest in pelagic logoon fish. Recent measurements of radionuclide concentrations in fish muscle tissue and other marine dietary items from international sources show that the average concentrations in species from the Marshall Islands are comparable to those in fish typically consumed as food in the United States and are generally lower than those in most international marine dietary items. The whole-body dose rates based on continuous consumption of 200 g/d of fish range from 0.028 to 0.1 mrem/y; the bone-marrow dose rates range from 0.029 to 0.12 mrem/y. The dose commitment, or 30-y integral doses, range from 0.00063 to 0.0022 rem for the whole body and from 0.00065 to 0.0032 rem for the bone marrow. (ERB)

## 5205 Site Resource And Use Studies

*REFER ALSO TO CITATION(S) 33154, 33819*

33830 **(LBL—13192) Marine mammals of Hawaii: a bibliography.** Payne, S.F. (Lawrence Berkeley Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 18p. NTIS, PC A02/MF A01. Order Number DE81030410.

This bibliography is a product of a literature survey on marine mammals at proposed OTEC sites in the Hawaiian Islands. Emphasis is on publications about abundance and distribution, migration routes, and feeding ecology of the marine mammals known to inhabit the main and leeward Hawaiian Islands. Some works on the general biology of marine mammals are also included. 214 references.

33831 **(LBL—13193) Marine mammals of Puerto Rico: a bibliography.** Payne, S.F. (Lawrence Berkeley Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 11p. NTIS, PC A02/MF A01. Order Number DE81030411.

This bibliography is the product of a literature survey on marine mammals at a proposed OTEC site near Punta Tuna, Puerto Rico. Included are reports of mammal sightings and strandings from Puerto Rico and adjacent Caribbean islands, reports containing information on distribution and abundance migration routes, and feeding ecology of those species known from the area. A few works on the general biology of marine mammals are also included. 96 references.

## 5206 Regulations

33832 (DOE/EP/10012—1, pp 24-36) **Water pollution.** Jun 1981. NTIS, PC A06/MF A01.

In Energy and environmental quality: case histories of impact management.

Case studies are used to illustrate existing environmental concerns over water pollution and energy source development. Pollution regulations and laws are covered in detail pertaining to project designs, operations, and public safety and health. (DLS)

33833 (DOE/EP/10012—1, pp 66-79) **Water resources.** Jun 1981. NTIS, PC A06/MF A01.

In Energy and environmental quality: case histories of impact management.

Energy development of water resources is an important aspect of environmental pollution and of conservation problems throughout the United States. Legal views of energy source development are expressed with an emphasis on water rights and case studies of environmental impacts of energy projects. (DLS)

# 53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

## 5301 Social And Economic Studies

*REFER ALSO TO CITATION(S) 32998, 33400*

33834 (DOE/EP/10012—1, pp 112-116) **Archaeological, historical, and cultural resources.** Jun 1981. NTIS, PC A06/MF A01.

In Energy and environmental quality: case histories of impact management.

Archaeological and historical resources have diminished at an increasing rate due to energy source development. Current trends and legal aspects of proposed and developed energy projects are discussed along with supportive case studies. (DLS)

33835 **(PNL-SA—9419) Technique for planning and managing industrial growth from the air-quality standpoint.** Allwine, K.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 23 Mar 1981. Contract AC06-76RL01830. 10p. (CONF-810393—1). NTIS, PC A02/MF A01. Order Number DE81028342.

From APCA spring speciality meeting; Renton, WA, USA (23 Mar 1981).

A technique has been developed for summing modeled air quality impacts from many sources onto a common grid. The computed concentration fields can come from any air quality model provided the same period of meteorology is used. At present the computed concentration fields from EPA models CRSTER and ISC can be overlayed onto the grid. The current area of application is for a 100 km by 100 km area but could be expanded to any management unit. Discussed will be current application of the technique and potential uses in planning and managing industrial growth.

33836 **Biotechnology in Canada: promises and concerns.** Ottawa, Ontario; Science Council of Canada (1980). 62p. (CONF-8009166—).

From Conference on biotechnology in Canada: promises and concerns; Aylmer, Quebec, Canada (16 Sep 1980).

The papers presented at the workshop and an edited summary of the discussion that followed are included. Conclusions and recommendations made by workshop participants are presented. (JGB)

33837 **Assessing environmental risks of energy.** Gleick, P.H.; Holdren, J.P. (Univ. of California, Berkeley). *American Journal of Public Health and the Nation's Health ;* **71**: No. 9, 1046-1050(Sep 1981).

The increased attention given by analysts, decision makers, and the public in recent years to the environmental impacts of energy production has not been an aberration or a fad; it is the natural consequence of a growing recognition that an increase in human well-being, rather than an increase in energy supply for its own sake, should govern society's energy choices. Since well-being is influenced by environmental conditions as much as by economic conditions, the wisdom of a given energy choice simply cannot be determined without systematic assessment of its environmental consequences. Some brief observations about the nature and state-of-the-art of this assessment, as reflected in recent summaries and reviews, are offered.

## 5302 Assessment Of Energy Technologies

*REFER ALSO TO CITATION(S) 33452, 33771, 33808, 33832, 33833, 33834, 33837, 33916*

**33838** (CONF-800433—, pp 501-511) **New technique of radiation dosimetry based on lyoluminescence.** Ettinger, K.V. (Univ. of Aberdeen, Foresterhill, Scotland); Mallard, J.R.; Vartsky, D. 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Lyoluminescence has been applied to the needs of radiation dosimetry. The effect can be observed in many categories of organic solids, including carbohydrates, amino acids, proteins and certain polymers. Simple solvents like water can be used for this purpose but higher sensitivity is attained by application of sensitizers. The paper describes the main applications of lyoluminescence dosimetry and gives an outline of the experimental techniques involved in its use.

**33839** **(DOE/EP—0026) Energy technologies and the environment: environmental information handbook.** (Aerospace Corp., Germantown, MD (USA)). Jun 1981. Contract AT03-76EV74010. 515p. NTIS, PC A22/MF A01. Order Number DE81029809.

This manual draws together information on the environmental consequences of energy technologies that will be in use in the United States during the next 20 years. We hope it will prove useful to planners, policymakers, legislators, researchers, and environmentalists. The information on environmental issues, control technologies, and energy production and conservation processes should also be a convenient starting point for deeper exploration. Published references are given for the statements, data, and conclusions so that the interested reader can obtain more detailed information where necessary. Environmental aspects of energy technologies are presented in a form suitable for government and public use and are intended to assist decisionmakers, researchers, and the public with basic information and references that can be relied upon through changing policies and changing world energy prices.

**33840** **(DOE/EP—0028) Technology characterizations: environmental information handbook. Second edition.** (Aerospace Corp., Germantown, MD (USA); Mueller Associates, Inc., Baltimore, MD (USA)). Jun 1981. Contract AT03-76EV74010;AC01-81EV10450. 340p. NTIS, PC A15/MF A01. Order Number DE81029993.

This Handbook deals with environmental characterization information for a range of energy supply systems. Environmental residuals and physical resource requirements are the principal information provided. The specific energy technologies included are divided into the following general areas: nuclear, petroleum, natural gas, synthetic fuels, coal, solar, geothermal, and hydroelectric. Each technology is characterized in terms of the resources required, costs, residuals released, energy products, and occupational safety and health data. The information is based on a facility of particular size and design, with the data presented on the basis of annual quantities or total facility lifetime quantities (e.g., construction materials), as appropriate. In addition, the data are normalized to $10^{12}$ (1 trillion) Btu energy output to facilitate cross-technology comparison and use of the data in computerized data bases. (PSB)

**33841** (DOE/EP/10012—1, pp 38-44) **Solid waste.** Jun 1981. NTIS, PC A06/MF A01.

In Energy and environmental quality: case histories of impact management.

Hazardous solid waste and the impacts on the environment are discussed. Pollution laws and regulations and their relation to energy source development are referred to in several illustrative case studies. (DLS)

**33842** (DOE/EP/10012—1, pp 52-63) **Radiation.** Jun 1981. NTIS, PC A06/MF A01.

In Energy and environmental quality: case histories of impact management.

Radiation doses from many sources posing health hazards has led to the development of radiation protection programs. The nuclear industry, including all legal aspects and regulations are discussed along with current trends in energy technologies, disposal, and illustrative case studies. (DLS)

**33843** (DOE/EP/10012—1, pp 94-109) **Wildlife.** Jun 1981. NTIS, PC A06/MF A01.

In Energy and environmental quality: case histories of impact management.

Wild animals and plants are biological indicators of the health of the overall environment. Environmental impacts on wildlife as a result of energy source development are reviewed in legal aspects, current trends, and case studies. (DLS)

# 55 BIOMEDICAL SCIENCES, BASIC STUDIES

## 5501 Behavioral Biology

*REFER ALSO TO CITATION(S) 33862*

## 5502 Biochemistry

*REFER ALSO TO CITATION(S) 33836, 33853, 33864, 33867, 33873, 33874, 33875, 33878, 33893, 33904, 33905*

**33844** (CONF-800433—, pp 378-387) **Application of PIXE and INAA to biological materials: analysis of serum and serum albumin.** Maenhaut, W. (Inst. Nucleaire Wetenschappen, Gent, Belgium); De Reu, L.; Tomza, U.; De Roose, J. 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Particle-induced x-ray emission (PIXE) analysis and instrumental neutron activation analysis (INAA) were applied to study the trace element composition of human serum and serum albumin samples. Although most of the elements were present at a concentration level below a few $\mu$g/ml, up to 19 elements could be measured in some samples. The precision of the PIXE technique, as determined by analyzing up to 20 targets from one sample, was as low as 3% for those elements where counting statistics were good. A comparison between the PIXE and INAA results showed close agreement, indicating that PIXE can yield data which are accurate to within 10%. In the INAA procedure, the measurement of the elements with short- or medium-long-lived product radionuclides (half-life $<$ 3 d) was seriously hampered by the presence of large $^{38}$Cl and $^{24}$Na activities. Those elements were normally better determined by PIXE. INAA on the other hand generally proved to be more sensitive than PIXE for the elements which were measured after 3 to 4 weeks cooling.

**33845** (CONF-800433—, pp 480-490) **Retention of metabolized trace elements in rat tissues: silver, cerium, caesium, manganese, scandium and tin.** Iyengar, G.V.; Kasperek, K.; Feinendegen, L.E. (Nuclear Research Center, Juelich, Germany). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

We investigated the losses of Ag, Ce, Cs, Mn, Sc and Sn during freeze drying and oven drying at 80, 105 and 120 degrees centigrade by incorporating suitable radionuclides into rat tissues. No loss was observed for any of the 6 elements in any of the tissues studied during freeze drying. Whereas, oven drying revealed certain tissue specificity in the retention of these elements and showed the following trend: A significant loss of Sn was observed in muscle even at 80 degrees centigrade and for kidney and liver at 105 degrees centigrade. Also Ce and Mn were lost from heart and muscle at this temperature. Elevating the temperature to 120 degrees centigrade was found to be safe only for Ag and Cs in all the tissues. For the remaining 4 elements the losses seen were about 5 percent for Ce in brain and heart, for Sc in fur and heart, and for Mn in liver and muscle; up to 10 percent for Sc in kidney and muscle, and for Sn in blood, fur, heart, liver, ovary and uterus.

Losses exceeding 10 percent were seen for Sn in brain, kidney, lung and muscle.

33846 **(LBL—12979) Computer simulation of organic and biological molecules.** Olson, A.J. (ed.). (Lawrence Berkeley Lab., CA (USA)). 1981. Contract W-7405-ENG-48. 80p. (CONF-810149—). NTIS, PC A05/MF A01. Order Number DE81029948.

From Workshop on computer simulation of organic and biological molecules; Pacific Grove, CA, USA (5 Jan 1981).

Seven sessions were held altogether followed by a round table discussion. The first day's sessions were divided into discussion of: (1) molecular mechanics applied to smaller molecules; (2) conformational studies of nucleotides; and (3) dynamics and energetics of small peptides. The second day's discussion involved larger systems including proteins, and protein hydration. The final session continued the theme of introducing solvent with talks of Monte Carlo simulations of hydration. Two talks on drug design were intercalated in two of the sessions, representing a new community exhibiting great interest in the field. The round table discussion focused on the desirability of writing a general software package for calculating the properties of molecular systems from classical mechanics using an analytical representation of the energy.

33847 **Two-dimensional analysis of human lymphocyte proteins: I. An assay for lymphocyte effectors.** Willard, K.E.; Anderson, N.G. (Argonne National Lab., IL). Contract W-31-109-ENG-38. *Clinical Chemistry (Winston-Salem, North Carolina)*; **27**: No. 8, 1327-1334(Aug 1981).

We describe an assay for lymphocyte effectors that is capable of establishing the existence of regulators of lymphocyte gene expression (including post-transcriptional control and protein processing) and has the ability to characterize the response at the molecular level. The hypothesis that circulating effector substances excreted through the kidney can be actively present in human urine was tested with this assay. Thus, biologically active protein molecules in urine were detected at concentrations of less than 1 mg/L and over a wide range of dilutions. Activities were detected and quantiated by culturing human lymphocytes with human urinary proteins in the presence of [$^{35}$S]methionine and subsequently analyzing the labeled lymphocyte proteins by two-dimensional gel electrophoresis. Thus, protein analysis by two-dimensional gels was used to indirectly detect changes produced in cultured lymphocytes after exposure to regulatory molecules. Proteins or sets of lymphocyte proteins appeared or disappeared after exposure to normal or pathological human urinary proteins. Normal human urinary proteins triggered the appearance of sets of proteins referred to by number as the Urocon proteins and suppressed the synthesis of protein sets referred to as Urocof proteins. In addition to the normal alterations described, urinary proteins from individuals with influenza or acute leukemia and after renal transplantation were capable of inducing unique alterations in lymphocyte patterns.

33848 **Proteins of human semen. I. Two-dimensional mapping of human seminal fluid.** Edwards, J.J.; Tollaksen, S.L.; Anderson, N.G. (Argonne National Lab., IL). Contract W-31-109-ENG-38. *Clinical Chemistry (Winston-Salem, North Carolina)*; **27**: No. 8, 1335-1340(Aug 1981).

The proteins in human seminal plasma were mapped by high-resolution two-dimensional electrophoresis (ISO-DALT and BASO-DALT systems). When analyzed under dissociating conditions, samples from normal fertile males revealed a pattern of over 200 proteins, ranging in mass from 10,000 to 100,000 daltons. Comparison of the mapped proteins from these males and those who had undergone vasectomy allowed us to identify one series of glycoproteins as missing from the semen from vasectomized individuals. Glycoproteins isolated by affinity chromatography with use of concanavalin A were also mapped. Some of the protein spots were identified either by coelectrophoresis with purified proteins or by the electrophoretic transfer of proteins to nitrocellulose sheets and subsequent detection by immunological procedures. The proteins identified include a number of serum proteins as well as prostatic acid phosphatase and creatine kinase. Proteolytic events shown to occur during the liquefaction of semen that occurs early after collection indicate the importance of carefully controlled collection and preparation methods for clinical evaluation of seminal plasma. Ethylenediaminetetraacetic acid and phenylmethylsulfonyl fluoride inhibit this proteolysis.

33849 **Regulation of retinol-binding protein metabolism by glucocorticoid hormones in cultured $H_4II$ $EC_3$ liver cells.** Borek, C.; Smith, J.E.; Soprano, D.R.; Goodman, D.S. (Columbia Univ., New York, NY). Contract EP-78-S-02-4733. *Endocrinology*; **109**: No. 2, 386-391(Aug 1981).

Studies were conducted to explore the effects of glucocorticoid hormones on the regulation of the metabolism of retinol-binding protein (RBP) by $H_4II$ $EC_4$ rat hepatoma cells in culture. Cortisol, corticosterone, and the synthetic glucocorticoid analog dexamethasone all induced a 2- to 3-fold increase in the accumulation of RBP. Half-maximal stimulation occurred at concentrations of dexamethasone in the range of 1 to 5 nM. Progesterone in the concentration range of 1 to 10 $\mu$M, inhibited the stimulatory effect of dexamethasone. Progesterone alone in this concentration range had no effect on RBP metabolism. The addition of retinol over a range from 3.5 nM to 3.5 $\mu$M stimulated a dose-dependent secretion of RBP from the cells into the medium. When studied over a wide range of concentrations, retinol and dexamethasone incubated together produced approximately additive increases in the accumulation of RBP. Dexamethasone, moreover, did not affect the retinol-induced secretion of RBP. Thus, retinol and dexamethasone appear to function via different and independent mechanisms to regulate the metabolism of RBP by the liver cell.

33850 **Enzymatic synthesis of 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine, a hypotensive and platelet-aggregating lipid.** Wykle, R.L.; Malone, B.; Snyder, F. (Oak Ridge Associated Universities, TN). Contract AC05-760R00033. *Journal of Biological Chemistry*; **255**: No. 21, 10256-10260(1980).

1-Alkyl-2-acetyl-sn-glycero-3-phosphocholine, derived chemically from choline plasmalogens of beef heart, has been shown to possess powerful antihypertensive activity and to be an extremely potent platelet-activating factor. In the present study, microsomal preparations of rat spleen were shown to synthesize 1-hexadecyl-2-acetyl-sn-glycero-3-phosphocholine by an acetyl-CoA:1-alkyl-2-lyso-sn-glycero-3-phosphocholine acetyltransferase reaction; the acetyltransferase appears to be different from the acyltransferase responsible for the transfer of palmitate to glycerolipids.

33851 **Convenient synthesis of 3-keto bile acids by selective oxidation of bile acids with silver carbonate-Celite.** Tserng, K.Y. (Argonne National Lab., IL). *Journal of Lipid Research*; **19**: No. 4, 501-504(May 1978).

A number of 3-keto bile acids were synthesized by the selective oxidation of bile acid methyl esters with silver carbonate-Celite in refluxing toluene. The pure 3-keto bile acids were isolated simply by filtering the reaction mixture and concentrating the filtrate. The relation of the bile acid structure to the oxidation rate is also discussed. 2 figures.

33852 **Cytotoxic reactions of free radical species of oxygen.** Borg, D.C.; Schaich, K.M.; Elmore, J.J. Jr.; Bell, J.A. (Brookhaven National Lab., Upton, NY). Contract EY-76-C-02-0016. *Photochemistry and Photobiology*; **28**: 887-907(1978).

Autooxidation reactions related to selective cell killing in vivo and present oxygen uptake and EPR data on the molecular nature of these changes, with a note on a reaction used to test for singlet oxygen were reported. Selective obliteration by 6-hydroxydopamine, 6-aminodopamine and their congeners of beta-adrenergic cell receptors and of adrenergic and dopaminergic neurons in vivo and in vitro have been reported recently. These effects devolve from autoxidation of the compounds in situ after appropriate biological concentration, but it is unclear whether cytotoxicity is mediated by the reactive oxygen species themselves or by nucleophilic reactions of the product quinones. Because of the possibility of harnessing these reactions for a generalized chemical surgery if the former mechanism is operative, and because many other oxidative damage reactions involving unsaturated lipids of biomembranes seem to share similar autoxidative initiating and chain-carrying steps, we have studied the autoxidation of ascorbate and other reductants catalyzed by polyhydroxy quinols related to 6-hydroxydopamine. We find that superoxide anion mediation may or may not

be important, depending on redox potentials and reaction kinetics of particular compounds. To the extent that the cellular toxicity of these compounds is oxidative in nature, it is facilitated by - and may depend upon - hydroxyl radical production dueto Fenton-type reactions. Likely Fenton reactants in vivo are hydrogen peroxide produced from the quinol-catalyzed autoxidations and non-heme iron reduced cyclically by superoxide anions from the same autoxidations. Studies using flow systems adapted for EPR at 35 GHz have provided support for some of the reaction mechanisms proposed. In nonaqueous solvents ceric oxidation produced transient free radicals from hydrophobic diphenyl and isobenzo furans, which are often cited as specific probes for singlet oxygen detection in biochemisty. 13 figures, 2 tables.

## 5503 Cytology

*REFER ALSO TO CITATION(S) 33836, 33893*

33853 **Gradient coupling in isolated intestinal cells.** Kimmich, G.A. (Univ. of Rochester, NY). Contract AC02-76EV03490. *Federation Proceedings ;* **40**: No. 10, 2474-2479(Aug 1981).

Work with isolated intestinal cells summarized below shows that: (1) an answer to the energetic adequacy question for $Na^+$-dependent transport systems cannot be provided unless solute fluxes by all routes are taken into account; (2) the conventional view of transport efficiency is in fact a measure of membrane leakiness to solute rather than a measure of innate efficiency for the $Na^+$-dependent carrier; (3) uncontrolled sugar-induced changes in membrane potential introduce a systematic error in measurements of the $Na^+$:sugar coupling stoichiometry; (4) with appropriate control of the membrane potential the measured coupling ratio is 2 $Na^+$ per sugar molecule; and (5) a 2:1 coupling ratio allows for theoretical maximum sugar gradients of several hundred fold via a mechanism sharply dependent on the membrane potential.

33854 (LBL—11986, pp 5.40-5.42) **Membrane oxidative damage.** Packer, L.; Quintanilha, A.; Mehlhorn, R.; Augusto, O.; Maguire, J.; Davies, K. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

Our studies have focused on the effects of environmental factors and pollution on mammalian cellular membranes. Our working hypothesis has been that reactive species of oxygen would react with cellular components thereby altering their structure and function. We have extended our work to studies of microsomal enzymes. The use of a variety of different spin probes and their photomediated reduction and/or destruction has been a powerful tool in implicating free-radical intermediates in the mechanisms of photooxidative damage to biological membranes. Free iron has been evaluated for its prooxidant effects.

33855 **Diminished osmotic fragility of human erythrocytes following the membrane insertion of oxygenated sterol compounds.** Streuli, R.A.; Kanofsky, J.R.; Gunn, R.B.; Yachnin, S. (Univ. of Chicago, IL). Contract AC02-80EV10357. *Blood ;* **58**: No. 2, 317-325(Aug 1981).

From 23. annual meeting of American Society of Hematology; San Antonio, TX, USA (5 Dec 1981).

Oxygenated sterol compounds (OSC), when incubated for 1 hr with human erythrocytes in lipoprotein-depleted medium at concentrations of 0.625-5 x $10^{-6}$M, are inserted into the cell membrane and remain there despite subsequent washing of the cells. The insertion results in expansion of the surface area of the red cell ghost membrane, an increase in critical hemolytic volume, and as a consequence, in dimished osmotic fragility of the erythrocytes. This effect is seen with echinocyte-forming as well as with non-echinocyte-forming OSC. Erythrocytes treated with OSC do not differ from control cells with respect to their mean cell volume (MCV) in isotonic solution, water content, ion fluxes, and filterability through polycarbonate filters. The shift of the osmotic fragility curve toward lower NaCl concentrations is proportional to the amount of OSC inserted into the red cell membrane. 7B-Hydroxycholesterol, 22-ketocholesterol, and 20 α-hydroxycholesterol are the most potent inhibitors of osmotic lysis. The effect of OSC on osmotic fragility is diminished if the erythrocytes are incubated in a lipoprotein-containing medium; free cholesterol, however, does not change this effect. Various progesterones also protect red cells from osmotic lysis if the erythrocytes are directly exposed to the compounds present in the hypotonic NaCl solutions.

33856 **Unstable cellular differentiation in adenosquamous cell carcinoma.** Steele, V.E.; Netteshelm, P. (National Inst. of Environmental Health Sciences, Research Triangle Park, NC). Contract W-7405-ENG-26. *Journal of the National Cancer Institute ;* **67**: No. 1, 149-154(Jul 1981).

For the determination of whether two or more stem lines with fixed or stable differentiation are present in a growing mixed adenosquamous cell carcinoma, two different mixed tumors, derived from transformed F344 rat tracheal epithelium, were dissociated and ten single cells were isolated from each tumor. All clones were then inoculated into animals for the assessment of in vivo differentiation. Of the ten single cell clones isolated from the first tumor, seven clones produced mixed adenosquamous carcinomas and three produced adenocarcinomas in which no squamous cell component was found. From the second tumor, eight clones produced mixed tumors and two produced squamous cell carcinomas in which no adenocarcinoma component was found. These studies strongly suggest that the mixture of differentiated cell types in adenosquamous cell carcinomas is not the result of a mixture of stem cells with one fixed phenotype within the tumor, but rather is the result of an instability of differentiation; the neoplastic cells can express both types of differentiation.

33857 **Autoradiographic technic for Plutonium, Polonium, and Promethium tissue sections.** Carpenter, S.G. *Journal of Histotechnology ;* **1**: No. 3, 81-83(Mar 1978).

Syrian hamster lung sections containing $^{238}Pu$, $^{239}Pu$, $^{210}Po$, or $^{147}Pm$ are deparaffinized and hydrated to water. The slides are dipped in NTB emulsion, allowed to dry overnight, and exposed in Bakelite boxes at room temperature. They are then developed in D-19 for two to four minutes, rinsed in distilled water for ten seconds, fixed in Kodak fixer for five minutes, and washed at least 30 minutes in distilled water before staining with nuclear fast red and indigo-carmine. This autoradiographic technic, in conjunction with this particular staining procedure, gives a quick, efficient method for working with different α- and β-emitting radionuclides.

## 5504 Genetics

*REFER ALSO TO CITATION(S) 33836, 33847, 33873, 33874, 33875, 33881, 33893, 33908*

33858 **(BNL—29733) Transformation of Haemophilus influenzae by recombinant molecules.** Setlow, J.K.; McCarthy, D.R.; Clayton, N.L. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 9p. (CONF-8106127—1). NTIS, PC A02/MF A01. Order Number DE81032039.

From 3. Cleveland symposium on macromolecules: recombinant DNA; Cleveland, OH, USA (22 Jun 1981).

A gene library of Haemophilus influenzae DNA has been constructed by ligating chromosomal DNA from cells resistant to a number of antibiotics, together with DNA of the H. influenzae plasmid RSF0885. Before ligation both DNAs were cut with the enzyme PvuII. The ligated DNA was allowed to enter competent H. influenzae sensitive to the antibiotics and selection was made for resistance to ampicillin, conferred by the plasmid RSF0885 DNA. Plasmids conferring resistance to various other antibiotics, as well as to ampicillin, have been obtained by this procedure and subsequent selection for chromosomal markers.

33859 **(DOE/EV/03214—T3) Progress report on research on human genetics in Iceland.** (Iceland Univ., Reykjavik). 31 Oct 1981. Contract AC02-76EV03214. 15p. (COO—3214-20). NTIS, PC A02/MF A01. Order Number DE81030171.

Icelandic population records are being used to investigate the possible inheritance of disabilities and diseases as well as other characters and the effect of environment on man. This report of research covers the period July 1980 to 1981. The investigation was begun in 1965 by the Genetical Committee of the University of Ice-

land, and the materials used are demographic records from the year 1840 to present and various medical information. The records are being computerized and linked together to make them effective for use in hereditary studies.

33860 **Endomitotic effect of a cell cycle mutation of Saccharomyces cerevisiae.** Schild, D.; Ananthaswamy, H.N.; Mortimer, R.K. (Univ. of California., Berkeley). Contract W-7405-ENG-48. *Genetics ;* **97**: No. 3-4, 551-562(Mar 1981).

A recessive temperature-sensitive mutation of Saccharomyces cerevisiae has been isolated and shown to cause an increase in ploidy in both haploids and diploids. Genetic analysis revealed that the strain carrying the mutation was an aa diploid, although MNNG mutagenesis had been done on an a haploid strain. When the mutant strain was crossed with an $\alpha\alpha$ diploid and the resultant tetraploid sporulated, some of the meiotic progeny of this tetraploid were themselves tetraploid, as shown by both genetic analysis and DNA measurements, instead of diploid as expected of tetraploid meiosis. The ability of these tetraploids to continue to produce tetraploid meiotic progeny was followed for four generations. It was found that tetraploidization was independent of sporulation temperature, but was dependent on the temperature of germination and the growth of the spores. Increase in ploidy occurred when the spores were germinated and grown at 30°, but did not occur at 23°. Two cycles of sporulation and growth at 23° resulted in haploids, which were shown to diploidize within 24 hr when grown at 30°.

33861 **Third-chromosome mutagen-sensitive mutants of Drosophila melanogaster.** Boyd, J.B.; Golino, M.D.; Shaw, K.E.S.; Osgood, C.J.; Green, M.M. (Univ. of California, Davis). *Genetics ;* **97**: No. 3-4, 607-623(Mar 1981).

A total of 34 third chromosomes of Drosophila melanogaster that render homozygous larvae hypersensitive to killing by chemical mutagens have been isolated. Genetic analyses have placed responsible mutations in more than eleven complementation groups. Mutants in three complementation groups are strongly sensitive to methyl methanesulfonate, those in one are sensitive to nitrogen mustard, and mutants in six groups are hypersensitive to both mutagens. Eight of the ten loci mapped fall within 15% of the genetic map that encompasses the centromere of chromosome 3. Mutants from four of the complementation groups are associated with moderate to strong meiotic effects in females. Preliminary biochemical analyses have implicated seven of these loci in DNA metabolism.

33862 **Fitness and density-dependent population growth in Drosophila melanogaster.** Mueller, L.D.; Ayala, F.J. (Univ. of California, Davis). *Genetics ;* **97**: No. 3-4, 667-677(Mar 1981).

The density-dependent rates of population growth were determined for 26 populations of Drosophila melanogaster maintained in the serial transfer system. Twenty-five populations were homozygous for an entire chromosome 2 sampled from nature; the other was a random heterozygous population. Rates of population growth around the carrying capacity cannot explain the large fitness depression of these lines. However, the homozygous lines show large differences in rates of population growth at low densities relative to the random heterozygous standard. The average relative fitness of the homozygous lines, as determined from the growth rates at the lowest density, is 0.51.

33863 **Density- and frequency-dependent selection at the Mdh-2 locus in Drosophila pseudoobscura.** Tosic, M.; Ayala, F.J. (Univ. of California, Davis). *Genetics ;* **97**: No. 3-4, 679-701(Mar 1981).

We have studied differences in the number of Drosophila pseudoobscura produced in a culture when the flies differ with respect to two alleles (F and S) at the Mdh-2 locus, which codes for a malate dehydrogenase enzyme. The studies were done at low and at high density in two- and three-genotype combinations (S/S, F/F and S/F), with one-genotype cultures as controls. Density affects the fitness of the Mdh-2 genotypes. Different genotypes are differently affected, and the genotype of the competitors also makes a difference on the fitness of a given genotype. When three genotypes are present in a culture, particularly at high density, intergenotypic competition is less intense than intragenotypic competition at several frequency combinations. The fitness of the genotypes is frequency dependent in both two-genotype and three-genotype combinations. An inverse relationship between frequency and fitness is observed at high density. Forty independent strains, sampled from a natural population, were used in the experiments. This ensures that more than 95% of the variation present in the genome in the natural population is also present in the experimental cultures.

## 5505 Metabolism

*REFER ALSO TO CITATION(S) 33849, 33850*

33864 **In vivo metabolism of a new class of biologically active phospholipids: 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine, a platelet activating-hypotensive phospholipid.** Blank, M.L.; Cress, E.A.; Whittle, T.; Snyder, F. (Oak Ridge Associated Universities, TN). Contract AC05-76OR00033. *Life Sciences ;* **29**: No. 8, 769-775(24 Aug 1981).

This report describes the in vivo metabolism of a new class of naturally occurring biologically active phospholipids (1-alkyl-2-acetyl-sn-glycero-3-phosphocholines) that can cause hypotension and platelet aggregation. After intravenous injection in male rats, the acetylated ether phospholipid (1-[1',2'-$^3$H]alkyl) is rapidly cleared (T/sub 1/2/ $\simeq$ 30 s) from blood and its metabolites are found in a variety of tissues. The tissues containing the highest levels of radioactivity are lung, liver, spleen, and kidney. Chromatographic results showed that a considerable portion of the active lipid is not readily catabolized in some of the major tissues examined; however, inactive metabolites were also found, mainly 1-alkyl-2-lyso-sn-glycero-3-phosphocholine and 1-alkyl-2-acyl-sn-glycero-3-phosphocholine; the latter has a long chain fatty acid at the sn-2 position instead of the acetate. The findings are consistent with our earlier data that show these same tissues have the most active enzyme systems for metabolizng 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine.

## 5506 Medicine

*REFER ALSO TO CITATION(S) 33623, 33689, 33844, 33848, 33855, 33857, 33878, 33882, 33882*

33865 (CONF-800433—, pp 54-59) **Direct image reconstruction with limited angle projection data for computerized tomography.** Inouye, T. (Toshiba Research and Development Center, Kawasaki, Japan). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Discussions are made on the minimum angle range for projection data necessary to reconstruct the complete CT image. As is easily shown from the image reconstruction theorem, the lack of projection angle provides no data for the Fourier transformed function of the object on the corresponding angular directions, where the projections are missing. In a normal situation, the Fourier transformed function of an object image holds an analytic characteristic with respect to two-dimensional orthogonal parameters. This characteristic enables uniquely prolonging the function outside the obtained region employing a sort of analytic continuation with respect to both parameters. In the method reported here, an object pattern, which is confined within a finite range, is shifted to a specified region to have complete orthogonal function expansions without changing the projection angle directions. These orthogonal functions are analytically extended to the missing projection angle range and the whole function is determined. This method does not include any estimation process, whose effectiveness is often seriously jeopardized by the presence of a slight fluctuation component. Computer simulations were carried out to demonstrate the effectiveness of the method.

33866 (CONF-800433—, pp 286-295) **Feasibility of using a novel pulsed neutron source for in vivo: prompt gamma analysis.** Biggin, H.C.; Morgan, W.D. (Sheffield City Polytechnic, England). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

This paper outlines the characteristics of a system which incorporates the convenience and availability of isotope neutron sources with the reduction in detection limit achieved by pulsed accelerator beams. The proposed technique involves the high speed rotation under shielding of one or more $^{252}Cf$ neutron sources around the circumference of a circle containing an aperture which directs the neutron beam towards the organ of interest. The resulting sequence of collimated neutron pulses are thermalized in the body to induce the emissions of capture gamma rays from a particular element. The emitted radiation is monitored using a detection system which is gated off during the presence of a neutron pulse. Limitations on neutron pulse length and detector count time require the attainment of a threshold rotational speed which depends on the duty cycle of the system. Analysis of the system characteristics indicates that, in comparison with the corresponding continuous irradiation system, a tenfold reduction in patient dose would result in an increase in detection limit of only 40%.

33867 (CONF-800433—, pp 360-368) **Neutron activation analysis of hair from breast cancer patients.** Othman, I.; Spyrou, N.M. (Univ. of Surrey, Guildford, England). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Hair samples from breast cancer patients were collected at the same time as tumour and normal tissues obtained during mastectomy, in order to determine elemental concentrations and investigate whether hair can act as an epidemiological monitor of the disease. Instrumental neutron activation analysis was used and concentrations for Na, Mg, S, Cl, Ca, Mn, Cu, Zn, Br, I, Sb, Ba, Au and Hg in the hair samples measured. No strong correlations were found between the concentrations of Cl, Cu, Zn and Br in hair and those in tumour tissues and in normal tissues. The level of Zn in the patients hair is low and that of Ca very high.

33868 (CONF-800433—, pp 398-408) **Feasibility study for the in vivo measurement of silicon and beryllium by nuclear techniques.** Ettinger, K.V.; Morgan, W.D.; Miola, U.; Vartsky, D.; Ellis, K.J.; Wielopolski, L.; Cohn, S.H. (Brookhaven National Lab., Upton, NY). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Silicosis is a chronic fibrosing of the lungs that may develop from exposure to free crystalline silica incurred in a variety of industries including mining, quarrying and stone cutting. Experiments have been performed to assess the feasibility of measuring silicon in vivo by means of the prompt neutron inelastic scattering reaction $^{28}Si(n,n'\gamma)^{28}Si$. The optimum neutron energy in terms of counts per dose delivered to a liquid tissue-equivalent phantom was found to be in the range 5 to 8 MeV. By pulsing the neutron beam and counting only in the on period it was possible to substantially reduce the background both from thermal neutron interactions in the phantom and also from the fast interfering reaction $^{31}P(n,\alpha)^{28}Si$. In final measurements with a realistic chest phantom no interferences from other prompt inelastic scattering reactions were observed. With one Ge(Li) detector of 19% relative efficiency, a detection limit of 0.6g silicon per rem was obtained. A system comprising six 25% efficient detectors would be capable of measuring normal lung silicon contents of about 0.1g. Berylliosis, a granulomatous lung disease, has been observed in persons with lung contents ranging from micrograms to tens of milligrams (a normal value is 1 to 2 μg). For gamma photons between 1.665 MeV and 2.225 MeV (the beryllium and deuterium photonuclear thresholds respectively), the production of neutrons is a unique property of beryllium which might be exploited for analysis in vivo. Experiments with a Pb-filtered $^{124}Sb$ source and an enriched $^{10}BF_3$ counter provided data from which it was projected that a 72-detector array might yield a detection limit of 3.4 mg Be for a lung dose of 2.5 rads. Possible methods for improving this result are discussed.

33869 (CONF-800433—, pp 409-414) **Evaluation of the diagnostic sensitivity of scattering measurements of bone density.** Roberts, J.G.; DiTomasso, E.; Webber, C.E. (McMaster Univ. Medical Center, Hamilton, Ontario). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

To obtain an indication of the in vivo sensitivity of a system for the measurement of os calcis density, we measured the ability of the system to detect the difference in density that exists between groups of subjects of different ages. The detected difference was similar to that observed by other accepted methods for skeletal investigation. Since the Compton scattering technique is the only method available for the non-invasive assessment of weight bearing trabecular bone, their further development and evaluation should be encouraged. A major step in this direction would be an improvement in the availability of high activity sources of $^{153}Gd$.

33870 **Technique for the selective heating of corneal stroma.** Doss, J.D.; Albillar, J.I. (Los Alamos Scientific Lab., NM). *Contact and Intraocular Lens Medical Journal ;* **6**: No. 1, 13-17(Jan 1980).

Conventional thermokeratoplasty, which relies upon thermal conduction from the epithelium into the stroma, does not generate a desirable temperature profile through the cornea. Previous reports show that temperature levels in the epithelium and in Bowman's membrane are excessive, often resulting in damage to these structures. In addition, this study shows that when corneal thickness exceeds approximately 300 microns, the central portion of the stroma probably will not reach critical shrinkage temperature. Shrinkage only in the superficial stroma may result in minimal and transitory alterations of corneal shape. Variation in treatment results may also occur due to the difficulty in precise control of treatment duration. An alternative corneal heating technique is discussed which appears to solve these three basic problems.

## 5507 Microbiology

*REFER ALSO TO CITATION(S) 33860, 33861, 33917*

33871 **Kinetics of the removal of iron pyrite from coal by microbial catalysis.** Hoffmann, M.R. (California Inst. of Tech., Pasadena); Faust, B.C.; Panda, F.A.; Koo, H.H.; Tsuchiya, H.M. *Applied and Environmental Microbiology ;* **42**: No. 2, 259-271(Aug 1981).

Different strains of Thiobacillus ferrooxidans and Thiobacillus thiooxidans were used to catalyze the oxidative dissolution of iron pyrite, $FeS_2$, in nine different coal samples. Kinetic variables and parametric factors that were determined to have a pronounced effect on the rate and extent of oxidative dissolution at a fixed $pO_2$ were: the bacterial strain, the nitrogen/phosphorus molar ratio, the partial pressure of $CO_2$, the coal source, and the total reactive surface area of $FeS_2$. The overall rate of leaching, which exhibited a first-order dependence on the total surface area of $FeS_2$, was analyzed mathematically in terms of the sum of a biochemical rate, $\nu_1$, and a chemical rate, $\nu_2$. Results of this study show that bacterial desulfurization (90 to 98%) of coal samples which are relatively high in pyritic sulfur can be achieved within a time-frame of 8 to 12 days when pulp densities are ≦ 20% and particle sizes are ≦ 74 μm. These results suggest that minimal nutrient additions may be required for a commercial desulfurization process.

33872 **Degradation of softwood, hardwood, and grass lignocelluloses by two Steptomyces strains.** Antai, S.P.; Crawford, D.L. (Univ. of Idaho, Moscow). *Applied and Environmental Microbiology ;* **42**: No. 2, 378-380(Aug 1981).

Two Streptomyces strains, S. viridosporus T7A and S. setonii 75Vi2, were grown on softwood, hardwood, and grass lignocelluloses, and lignocellulose decomposition was followed by monitoring substrate weight loss, lignin loss, and carbohydrate loss over time. Results showed that both Streptomyces strains substantially degraded both the lignin and the carbohydrate components of each lignocellulose; however, these actinomycetes were more efficient decomposers of grass lignocelluloses than of hardwood or softwood

lignocelluloses. In particular, these Streptomyces strains were more efficient decomposers of grass lignins than of hardwood or softwood lignins.

**33873 Spontaneous mitotic recombination in mms8-1, an allele of the CDC9 gene of Saccharomyces cerevisiae.** Montelone, B.A.; Prakash, S.; Prakash, L. (Univ. of Rochester, NY). Contract AC02-76EV03490. *Journal of Bacteriology ;* **147**: No. 2, 517-525(Aug 1981).

The methyl methane sulfonate (MMS)-sensitive mutation mms8-1 increases the rate of spontaneous mitotic intragenic recombination at five heteroallelic loci on three chromosomes. Complementation, segregation, and mapping studies indicate that mms8-1 is allelic to cdc9, known to be defective in deoxyribonucleic acid ligase. Both mms8-1 and cdc9 mutants are lethal in combination with the recombination-defective mutant rad52-1. Genetic analysis of spontaneous red/white sectors in an ade2-1/ade2-1 ade5/ + mms8-1/mms8-1 strain shows nonreciprocal recombinational events involving long chromosome segments. We also observe greater than expected rates of simultaneous recombination at loci on different chromosomes in both wild-type and mms8-1 mutants.

**33874 Adenovirus type 2 early proteins: assignment of the early region 1A proteins synthesized in Vivo and in Vitro to specific mRNAs.** Smart, J.E.; Lewis, J.B.; Mathews, M.B.; Harter, M.L.; Anderson, C.W. (Cold Spring Harbor Lab., NY). *Virology ;* **112**: No. 2, 703-713(30 Jul 1981).

We have investigated the relationships among the major proteins encoded by early region 1A of Ad2 by comparative analysis of their [$^{35}$S]methionine-labeled tryptic peptides using reverse phase high-performance liquid chromatography. In some instances the purified peptides were subjected to automatic sequential Edmund degradation in order to determine the position at which the methionine residues occur within the peptides. These peptides have then been located in the amino acid sequence predicted from the DNA sequence of the leftmost 4.5% of the viral genome. The data show that the 50,000, 46,000, and 42,000 molecular weight E1A proteins (all of which focus at ca. pH 6.0) obtained from Ad2-infected HeLa cells are derived from the 1.1 kb region 1A mRNA. Similarly, it is shown that two polypeptides, 58,000 (58K) and 48,000 (48K), result from cell-free translation of the 1.1 kb mRNA. The data are also consistent with the hypothesis that the in vivo 46,000, 42,000, and 38,000 molecular weight E1A proteins (all of which focus at ca pH 5.9) are derived from the 0.9 kb region 1A mRNA. Cell-free translation of this mRNA yields two polypeptides, 54,000 (54K) and 42,000 (42K).

**33875 Chromatographic evidence that the AAA-coding isoacceptor of lysine tRNA primes DNA synthesis in murine mammary tumor virus.** Waters, L.C. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Virology ;* **112**: No. 2, 766-769(30 Jul 1981).

Most of the tRNA encapsulated within the murine mammary tumor virus is tRNA/sup LYS/. The reversed-phase chromatographic pattern of tRNA/sup LYS/ isoacceptors in the viral free tRNA and in the 70 S-associated tRNA that is released at 65° is similar to the pattern in virus-producing cells. However, the more tightly bound 70 S-associated tRNA/sup LYS/ is significantly enriched in the AAA-coding isoacceptor. This isoacceptor, but not the AAG-coding one, primes MuMTV 35 S RNA-directed DNA synthesis in vitro.

**33876 Characteristics of environmental isolates of Legionella pneumophila.** Orrison, L.H. (Centers for Disease Control, Atlanta, GA); Cherry, W.B.; Fliermans, C.B.; Dees, S.B.; McDougal, L.K.; Dodd, D.J. *Applied and Environmental Microbiology ;* **42**: No. 1, 109-115(Jul 1981).

Thirty-eight cultures of Legionella pneumophila isolated from survace waters were characterized by their morphological, tinctorial, biochemical, and serological properties and by their ability to produce disease in guinea pigs. Their susceptibility to antimicrobial agents also was tested. When they were compared with clinical isolates, no important differences were found between cultures from the two sources. Sodium hippurate hydrolysis, gelatin liquefaction, pigment formation, and $\beta$-lactamase and alkaline phosphatase activity were useful in differentiating the four described species of Legionella. Hydrolysis of diacetylfluorescein and the inability to reduce nitrate help to distinguish Legionella species from other gram-negative bacterial rods.

**33877 Agglutinating antibody to Aeromonas hydrophila in wild largemouth bass.** Hazen, T.C. (Univ. of Puerto Rico, Rio Piedras); Esch, G.W.; Raker, M.L. Contract EY-76-S-09-0900. *Transactions of the American Fisheries Society ;* **110**: No. 4, 514-518(Jul 1981).

Among largemouth bass Micropterus salmoides in Par Pond, South Carolina, a significantly large percentage of those with red-sore disease were positive for anti-Aeromonas hydrophila agglutinin than of uninfected fish. Highest titers occurred during summer and fall, when the prevalence of the disease was declining. Most agglutinin activity was associated with a single serum fraction; the agglutinin has an apparent molecular weight of > 340,000 daltons, suggesting it may be a macroglobulin-like antibody. Homologous agglutinin reacted better with A. hydrophila than heterologous agglutinin. Differences in severity and duration of red-sore epizootics in the southeastern United States may be due to differing virulence among strains of A. hydrophila.

## 5509 Pathology

*REFER ALSO TO CITATION(S) 33856, 33877, 33882, 33884*

**33878** (CONF-800433—, pp 427-436) **Distribution pattern of small and trace elements in human cancerous tissues and normal human tissues.** Terai, M.; Yasuda, M.; Akabane, A.; Matsumoto, M.; Hashimoto, K. (Tokyo Metropolitan Univ., Japan). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The concentrations of the seventeen principal elements in six kinds of carcinomatous tissues and their surrounding non-cancerous tissues have been determined by non-destructive neutron activation analysis. There were differences in the distribution of the Ca, Mg, Fe, Cr, Co and Sc between the cancerous tissues. The consistency of the Ca and Mg in the cancerous tissuse was much more than those of surrounding non-cancerous tissues, in the cases of gastric cancers, cholangiocarcinomas, hepatocellular carcinomas and metastatic carcinoma.

**33879** (CONF-800433—, pp 459-469) **INAA studies of normal and diseased human brain.** Ehmann, W.D.; Markesbery, W.R.; Alauddin, M.; Goodin, D.T.; Hossian, T.I.M. (Univ. of Kentucky, Lexington). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Several trace elements have been implicated as neurotoxic factors in the human brain disorder known as Alzheimer's disease. In order to study trace element relationships in aging and with this disease, we have developed INAA procedures for the determination of approximately 20 elements in human brain tissue. The analytical approach is based on a series of sequential 14 MeV neutron and reactor thermal neutron irradiations of the same aliquants of freeze-dried brain tissue. The INAA determinations of aluminum at sub-microgram per gram levels posed special problems. Extremely short irradiations were required to minimize interferences from $^{24}$Na and $^{38}$Cl gamma-ray Compton interactions and high levels of bremsstrahlung radiation from interactions of high energy beta particles produced by the decay of $^{32}$P. In addition, the $^{31}$P(n,$\alpha$)$^{28}$Al fast neutron reaction provides a primary interference to the determination of aluminum by the $^{27}$Al(n,$\gamma$)$^{28}$Al thermal neutron reaction. Our approaches to the solution of a number of special analytical problems involved in the application of INAA to brain tissue are presented. Trace element baseline data for neurologically normal individuals have been obtained. Several reports in the literature have contended that exceptionally high values for aluminum abundances in human brain tissues are more common for individuals with Alzheimer's disease and that aluminum may play an etiological role in the disease. The aluminum data we have obtained to date from 136 brain samples derived from 20 control and 11

Alzheimer's patients do not support these contentions. However, a positive correlation of aluminum abundances with age in the control group has been confirmed. Interim data for other trace elements are briefly reviewed.

33880 (CONF-800433—, pp 491-499) **Influence of post mortem changes on the elemental composition of rat liver studied by atomic absorption spectrometry and neutron activation analysis.** Iyengar, G.V.; Kasperek, K.; Feinendegen, L.E. (Nuclear Research Center, Juelich, Germany). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The implication of post mortem changes such as cell swelling, imbibition and autolysis on the elemental composition profiles of body organs has been discussed. Liver has been chosen as an example. Retaining the liver inside the intact body for different periods of time at ambient temperature induced significant differences in its weight due to post mortem tissue degeneration. Livers from the animals that were frozen at -15°C also showed significant decrease in weight upon thawing on the third day. The effect of these changes on the concentrations of various elements was reflected differently depending upon the association of the elements with extracellular fluids and intracellular components. For example, concentration of K was more affected by the lysis of the cell and sustained losses up to 30% in relation to the control values, while the total content was reduced by more than 40% as a result of both lysis and partial liquefaction. For Na, differences ranging from +10 to -20% in concentrations and +20 to -40% in total content were observed which could be explained by fluid movements in and out of the organ. Among the trace elements, variations observed for Fe ranged from -20 and +40%, while both Cu and Zn were found to fluctuate between -20 and +20%. The loss observed in the total content in liver for the 5 trace elements studied (Cu, Fe, Mn, Rb and Zn) was found to be about 20 to 40%. Rinsing of the liver samples with distilled water depleted the electrolyte concentration up to 30%. Among the trace elements, while Cu, Fe and Zn were relatively unaffected, the losses were up to 20% both for Mn and Rb.

## 5510 Physiological Systems

*REFER ALSO TO CITATION(S) 33877, 33908*

33881 **Mammalian life histories: their evolution and molecular-genetic mechanisms.** Sacher, G.A. (Argonne National Lab., IL). pp 21-42 of Advances in pathobiology. 7. Aging, cancer, and cell membranes. Borek, C.; Fenoglio, C.M.; King, D.W. (eds.). New York, NY; Thieme-Stratton Inc. (1980).

This paper begins with a survey of the phylogeny of longevity in the class Mammalia, and finishes by comparing some longevity assurance processes in two related species of small rodents. The close association of species longevity with constitutional characteristics such as brain weight, body weight, metabolic rate, and body temperature led to the conclusion that longevity, like these other variables, is a constitutional characteristic of mammals. It was also shown that the shape of the life table, as specified by the ratio of the vulnerability parameter to the rate-of-aging parameter, is an evolved character, and this supports the conclusion that the entire survival characteristic of every species arose under positive selective influences, rather than by the adventitious accumulation of senescence genes. The longevity differences among 21 genotypes of laboratory mice were found to depend on constitutional variables in much the same way as longevity depends on these same variables between species. Finally, studies of cultured cells of the two species Mus musculus and Peromyscus leucopus showed that one type of DNA repair and several other aspects of cell stability were consistently superior in the cells of the longer-lived Peromyscus.

## 5520 Public Health

*REFER ALSO TO CITATION(S) 33726, 33727, 33738, 33739, 33740, 33741, 33771, 33808, 33812, 33832, 33833, 33834, 33837, 33841, 33842, 33906, 33916*

33882 (CONF-800433—, pp 354-359) **Chemist in the clinic.** Lenihan, J.M.A. (West of Scotland Health Boards, Glasgow). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Nuclear techniques have been useful, psychologically as well as operationally, in studying the impact of the chemical environment, internal and external, on the health of the individual and the community. These studies are characterized by an abundance of answers but not enough meaningful questions. If scientific insight can catch up with technology, important advances can be achieved.

33883 (CONF-800433—, pp 424-426) **Application of neutron activation analysis in a regulatory agency.** Stroube, W.B. Jr.; Tanner, J.T. (Food and Drug Administration, Washington, DC). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

The role of neutron activation analysis in a regulatory agency will be illustrated. Examples of applications to research and short term special problems will be examined.

33884 (CONF-800433—, pp 442-448) **Trace element analysis of human hair by proton induced X-ray excitation PIXE.** Aframian, A.; Shakiba, H.; Housseiney, A. (Atomic Energy Organization of Iran, Tehran). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

A simple non-destructive method of trace element analysis has been described based on proton induced x-ray excitation. Preliminary results for fifteen different elements have been presented, with particular reference to Lead as a mostly toxic pollutant. SubppM detection levels have been obtained and possible correlations between the pollution of the biosphere and certain medical ailments considered.

33885 (CONF-801259—, pp 97-136) **Health effects: indoor air quality research strategy plan.** Goyer, R. 1980. NTIS, PC A15/MF A01. Order Number DE81026488.

From Workshop on indoor air quality research needs; Leesburg, VA, USA (3 Dec 1980).

In order to study the generic problem of indoor air quality there is need to characterize features of air handling systems so they can be correlated with clinical complaints on one hand and the levels of pollutants as determined by monitoring efforts. If this is done, given the appropriate monitoring capability, there will begin to be available appropriate data to make risk assessments for effects of pollutants on people in buildings.

## 5530 Agriculture And Food Technology

33886 **(DOE/SR/10706—1) Growth and yield of loblolly, slash, and longleaf pines in the South Carolina Sandhills: third measurement. Final report.** Shain, W.A.; Helms, J.R. (Clemson Univ., SC (USA). Dept. of Forestry). 1980. Contract AS09-80SR10706. 16p. NTIS, PC A02/MF A01. Order Number DE81030836.

Forty-five one-acre plots were planted with loblolly, slash, and longleaf pine seedlings on selected sites on the Savannah River Plant. Survival on the plots was observed and recorded. The purpose of the study was to follow the growth and yield of three southern pines through one complete rotation. (ACR)

# 56 BIOMEDICAL SCIENCES, APPLIED STUDIES

## 5601 Radiation Effects

*REFER ALSO TO CITATION(S) 33024, 33025, 33361, 33623, 33644, 33827, 33828, 33829*

33887 **(DOE/EV/03728—T1) Progress report for mutagenic effect of radionuclides incorporated into DNA of Drosophilia melangaster.** Lee, W.R. (Louisiana State Univ., Baton Rouge (USA). Dept. of Zoology and Physiology). 1981. Contract AS05-76EV03728. 7p. (ORO—3728-14). NTIS, PC A02/MF A01. Order Number DE81030540.

One objective is to determine the proportion of tritium incorporated into different macromolecules of Drosophila germ cells. The other objective is to determine the nature of mutagenic lesions induced by tritium decay. A specific locus detection system for point mutations that can be analyzed at the molecular level was developed. (ACR)

33888 **(DOE/EV/10251—4) Biokinetic behavior of Tc in the red abalone, Haliotis rufescens: a reassessment.** Beasley, T.M.; Lorz, H.V.; Gonor, J.J. (Oregon State Univ., Newport (USA). Marine Science Center). 1981. Contract AT06-79EV10251. 20p. NTIS, PC A02/MF A01. Order Number DE81030324.

The biokinetic behavior of /sup 95m/Tc in the red abalone, Haliotis rufescens, is reviewed in light of recent experiments on other molluscs. Additional experimentation has confirmed that, when uptake is directly from labeled seawater, abalone exhibit concentration factors in excess of 100. Bivalve molluscs under the same experimental conditions have concentration factors that do not exceed 2. However, uptake and loss kinetics cannot be described by a single compartment model as had been previously advanced. Assimilation of /sup 95m/Tc by the abalone following a single feeding of labeled macroalga, Nereocystis pyrifera, is high (~ 45%) and loss kinetics are similar to those observed following direct uptake from seawater.

33889 **(ORNL—5692) DARTAB: a program to combine airborne radionuclide environmental exposure data with dosimetric and health effects data to generate tabulations of predicted health impacts.** Begovich, C.L.; Eckerman, K.F.; Schlatter, E.C.; Ohr, S.Y.; Chester, R.O. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 79p. NTIS, PC A04/MF A01. Order Number DE81030434.

Includes 1 sheet of 48x reduction microfiche.

The DARTAB computer code combines radionuclide environmental exposure data with dosimetric and health effects data to generate tabulations of the predicted impact of radioactive airborne effluents. DARTAB is independent of the environmental transport code used to generate the environmental exposure data and the codes used to produce the dosimetric and health effects data. Therefore human dose and risk calculations need not be added to every environmental transport code. Options are included in DARTAB to permit the user to request tabulations by various topics (e.g., cancer site, exposure pathway, etc.) to facilitate characterization of the human health impacts of the effluents. The DARTAB code was written at ORNL for the US Environmental Protection Agency, Office of Radiation Programs.

33890 **(PNL-SA—9315) Microdosimetry of lymphocytes irradiated by alpha particles.** Fisher, D.R.; Harty, R. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1981. Contract AC06-76RL01830. 26p. (CONF-8105112—1). NTIS, PC A03/MF A01. Order Number DE81030090.

From 29. annual scientific meeting of the Radiation Research Society; Minneapolis, MN, USA (31 May 1981).

This paper reports the use of internal microdosimetry techniques to reinvestigate the dosimetry of two very similar experiments with apparently contradictory dose-response results. Yields of dicentric chromosome aberrations induced in human blood lymphocytes following in vitro exposure to dissolved americium or plutonium at two separate laboratories produced linear dose-response functions, but the slopes of the best-fit straight lines differed by a factor of 12. Our microdosimetric analysis showed the results of one experiment to be inconsistent with a uniform distribution of activity. It also showed that the difference in slope could be attributed to differences in particulate size and spatial distribution as a result of dissimilarities in procedures used for preparing the actinide solutions.

33891 **(PNL-SA—9632) Problems in evaluating health effects of occupational and environmental exposures.** Gilbert, E.S. (Pacific Northwest Lab., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 23p. (CONF-810755—1). NTIS, PC A02/MF A01. Order Number DE81028440.

From Conference on statistical and epidemiological methods in ionizing radiation; Berkeley Springs, WV, USA (6 Jul 1981).

The assessment of health effects from low-level exposure to radiation is a matter of considerable controversy. Existing standards for exposure are based primarily on estimates of health effects obtained by extrapolation from effects of high-level exposures such as those experienced at Hiroshima and Nagasaki. Occupational and environmental exposures provide one source of data for this task. A number of studies of populations exposed in this manner have attracted recent attention. Because of the size of most of the groups and the magnitude of the exposures received, the amount that can be learned from such populations is severely limited. A number of the problems involved in analyzing and interpreting such data are addressed. Many of these problems are illustrated by a current study of the effects on mortality of occupational exposure to radiation at the Hanford plant.

33892 **Radioactivity measurements of former military personnel exposed to weapon debris.** Toohey, R.E.; Rundo, J.; Essling, M.A.; Sha, J.Y.; Oldham, R.D.; Sedlet, J.; Robinson, J.J. (Argonne National Lab., IL). *Science (Washington, D.C.)*; **213**: 767-768(14 Aug 1981).

Sixteen former military personnel who were present at the Smoky atmospheric nuclear weapon test have been investigated for internal deposits of radioactivity. Whole-body and thorax gamma-ray measurements, thorax and skeletal actinide measurements, and urinalyses for plutonium-239 and strontium-90 indicated no evidence of radioactivity in excess of that found in the general population.

33893 **Sensitivity of excision repair in normal human, xeroderma pigmentosum variant and Cockayne's syndrome fibroblasts to inhibition by cytosine arabinoside.** Cleaver, J.E. (Univ. of California, San Francisco). *Journal of Cellular Physiology*; **108**: No. 2, 163-173(Aug 1981).

Inhibition of the gap-filling, polymerizing step of excision repair by 1-$\beta$-D-arabinofuranosylcytosine (ara-C) after irradiation with ultraviolet light in human diploid fibroblasts resulted in the formation of persistent DNA strand breaks in $G_1$, $G_2$, and plateau phase cells, but not in S phase cells. Addition of hydroxyurea to ara-C resulted in partial inhibition of repair in S phase cells. These observations can be explained either in terms of changing roles in repair for different DNA polymerases throughout the cell cycle or by the presence of a pool of deoxycytidine nucleotides during S phase equivalent to an external source of deoxycytidine at 50 $\mu$M concentration. A similar concentration dependence on ara-C was observed for inhibition of repair in normal human, xeroderma pigmentosum (XP) variant, and Cockayne's syndrome cells. Ara-C produced a similar number of breaks in normal and Cockayne's syndrome cells. Ara-C produced a similar number of breaks in normal and Cockayne's syndrome cells but slightly more in XP variant cells. Exonuclease III and S1 nuclease independently both degraded about 50% of the $^3$H-thymidine incorporated into repaired regions in the presence of ara-C. Sequential digestion with both enzymes degraded nearly 90% of the repaired regions. These observations can be explained if excision repair proceeds by displacing the damaged strand so that both the $^3$H-labeled patch and the damaged region are still ligated to high molecular weight DNA and compete for the same complementary strand during in vitro incubation with the nucleases. The amount of $^3$H-thymidine incorporated in DNA by repair decreased with increasing concentrations of ara-C and hydroxyurea, suggesting that the incomplete patches became shorter

under these conditions. Extrapolation of the digestion kinetics with exonuclease III permits an estimate of the normal patch size of about 100 nucleotides, consistent with previous estimates.

33894 **How and why of in vitro oncogenic transformation.** Hall, E.J.; Miller, R.C. (Columbia Univ., New York, NY). Contract AC02-78EV04733. *Radiation Research ;* **87**: No. 2, 208-223(Aug 1981).

From Symposium on low dose and low dose rate effects and their significance; New Orleans, LA, USA (1 Jun 1980).

The techniques devised to study oncogenic transformation in vitro, involving established cell lines as well as fresh explants from hamster embryos, represent a powerful tool to study the mechanisms involved in radiation carcinogenesis. Large numbers of cells can be irradiated and transformation incidence scored over a wide range of doses down to as low as 0.01 Gy of X rays. When data with small confidence intervals are available for doses below 1 Gy, it becomes evident that the dose-response relationship has a complex shape and is not well represented by a linear relationship between transformation incidence and dose. It has been clearly demonstrated with this in vitro system that the temporal distribution of dose, in particular its protraction over a period of time, significantly enhances transformation incidence at relatively low doses. These experiments have important implications to the development of risk estimates for radiogenic cancer in humans exposed to low doses, which involves an extrapolation from the available data which relate to high dose levels.

33895 **Experimental radiation carcinogenesis: what have we learned.** Fry, R.J.M. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Radiation Research ;* **87**: No. 2, 224-239(Aug 1981).

From Symposium on low dose and low dose rate effects and their significance; New Orleans, LA, USA (1 Jun 1980).

The data from a number of relatively large-scale animal experiments that were designed to examine the effects of dose rate, fractionation, and radiation quality are now accumulating. Apart from the answers obtained to the questions that the experiments were designed to elucidate there are a number of lessons to be learned about experimental design, the inadequacies of current models, and the areas of our ignorance and misconceptions. There is no single mechanism of radiation carcinogenesis. The induction of the initial events of tumorgenesis may be similar in most tumor types, whereas the factors influencing expression vary. The effect of dose rate will depend on the mechanism involved. It has become clear that dose-response curves for neutron irradiation bend over at low doses which makes the estimate of the initial slope difficult. The precise contribution of various factors influencing the shape of the curves is not clear. Because of the marked variation in the shape of dose-response curves for low-LET radiation, RBE values vary almost infinitely.

33896 **Influence of noncarcinogenic secondary factors on radiation carcinogenesis.** Little, J.B. (Harvard Univ., Boston, MA). *Radiation Research ;* **87**: No. 2, 240-250(Aug 1981).

From Symposium on low dose and low dose rate effects and their significance; New Orleans, LA, USA (1 Jun 1980).

Recent evidence suggests that secondary factors play an important role in modulating the expression of carcinogenesis in irradiated cells both in vitro and in vivo. Results of studies on malignant transformation indicate that a sufficient capacity for cell division among initiated cells is essential for the expression of radiation transformation. Postirradiation exposure to certain tumor promoters can greatly enhance transformation induced by low doses of x rays, whereas incubation with other agents such as vitamins A and C or protease inhibitors can completely suppress transformation. Other evidence suggests that the initial alteration induced in cells by x rays may actually be a reversible epigenetic event such as an alteration in gene expression which involves most or all of the irradiated cells. Studies on the induction of lung cancer in hamsters show that when a very small dose of $\alpha$ radiation (0 to 2% tumor incidence) is followed up to 4 months later by intratracheal instillations of isotonic saline, a marked increase in the tumor incidence occurs (36 to 44%). Increased knowledge concerning such noncarcinogenic secondary factors should not only facilitate the estimation of the hazards of low-dose, low-dose-rate radiation exposure, but also seems essential if we are to develop a more rational approach to cancer prevention.

33897 **Abstracts of twenty-ninth annual meeting of the Radiation Research Society, Minneapolis, Minnesota, 31 May-4 June 1981.** *Radiation Research ;* **87**: No. 2, 373-509(Aug 1981).

This section contains 378 abstracts of papers presented at the twenty-ninth annual meeting of the Radiation Research Society. All items are presented as abstracts only and this issue of Radiation Research is the only source of these abstracts. (KRM)

33898 **Cytoplasmic membrane fraction that promotes septation in an Escherichia coli lon mutant.** Adler, H.I.; Carrasco, A.; Crow, W.; Gill, J.S. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Journal of Bacteriology ;* **147**: No. 2, 326-332(Aug 1981).

A particulate fraction derived from bacterial cells stimulates septation in irradiated Escherichia coli lon mutants when added to postirradiation plating media. It was established that the particles are derived from the cytoplasmic membrane and that they have been partially purified by sucrose density gradient centrifugation. These particles also contain the cytochrome-based respiratory activity of the cell. A variety of experiments established a correlation between the septation-promoting activity of the particles and their ability to remove oxygen from the postirradiation plating medium. It was suggested that the efficient removal of oxygen from the medium allowed the lon cells to repair radiation-induced damage to the septation mechanism.

33899 **Analysis of resynthesis tracts in repaired Escherichia coli deoxyribonucleic acid.** Kuemmerle, N.; Ley, R.; Masker, W. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Journal of Bacteriology ;* **147**: No. 2, 333-339(Aug 1981).

Excision repair of ultraviolet radiation-induced damage in a wild-type strain of Escherichia coli has been examined, using two methods for characterizing the resynthesis step of the repair process. Comparison of data obtained after both isopycnic analysis of repaired deoxyribonucleic acid and sedimentation velocity analysis of deoxyribonucleic acid after selective photolysis of bromouracil-containing repaired regions has shown that the repaired deoxyribonucleic acid molecules contain a semicontinuous distribution of sizes of repair tracts. Further analysis of our data suggests two major classes of repair patches, one about 20 to 40 nucleotides in length, and the other containing 1600 to 2000 nucleotides. Under the conditions employed, approximately 2 to 10% of the fully repaired regions are long repair patches.

33900 **Comparative mutagenesis and interaction between near-ultraviolet (313- to 405-nm) and far-ultraviolet (254-nm) radiation in Escherichia coli strains with differing repair capabilities.** Turner, M.A.; Webb, R.B. (Argonne National Lab., IL). *Journal of Bacteriology ;* **147**: No. 2, 410-417(Aug 1981).

Comparative mutagenesis and possible synergistic interaction between broad-spectrum (313- to 405-nm) near-ultraviolet (black light bulb [BLB]) radiation and 254-nm radiation were studied in Escherichia coli strains WP2 (wild type), WP2s (uvrA), WP10 (recA), WP6 (polA), WP6s (polA uvrA), WP100 (uvrA recA), and WP5 (lexA). With BLB radiation, strains WP2s and WP6s demonstrated a high level of mutagenesis, whereas strains WP2, WP5, WP6, WP10, and WP100 did not demonstrate significant mutagenesis. In contrast, 254-nm radiation was mutagenic in strains WP2, WP2s, WP6, and WP6s, but strains WP5, WP10, and WP100 were not significantly mutated. The absence of mutagenesis by BLB radiation in lexA and recA strains WP10, WP5, and WP100 suggests that $lex^+$ $rec^+$ repair may play a major role in mutagenesis by both BLB and 254-nm radiation. The hypothesis that BLB radiation selectively inhibits $rec^+$ $lex^+$ repair was tested by sequential BLB-254 nm radiation. With strain WP2, a fluence of 30 $J/m^2$ at 254 nm induced $trp^+$ revertants at a frequency of $15 \times 10^{-6}$. However, when $10^3$ $J/m^2$ or more BLB radiation preceded the 254-nm exposure, no $trp^+$ revertants could be detected. A similar inhibition of 254-nm mutagenesis was observed with strain WP6 (polA). However, strains WP2s (uvrA) and WP6s (polA uvrA) showed enhanced 254-nm mutagenesis when a prior exposure to BLB radiation was given.

**33901 Molecular mechanisms of pyrimidine dimer excision in Saccharomyces cerevisiae: excision of dimers in cell extracts.** Reynolds, R.J.; Love, J.D.; Friedberg, E.C. (Stanford Univ., CA). Contract AS03-76SF00326. *Journal of Bacteriology ;* **147**: No. 2, 705-708(Aug 1981).

Cell-free extracts prepared from rad1-19, rad2-2, rad3-1, rad4-3, rad7-1, rad10-1, rad14-1, rad16-1, and cycl-1 (rad7) mutants of Saccharomyces cerevisiae all catalyze the preferential excision of thymine-containing pyrimidine dimers from ultraviolet-irradiated DNA specifically incised with M. luteus ultraviolet deoxyribonucleic acid incising activity.

**33902 Genetic constraints in the induction of the immune response to Ehrlich ascites tumor in mice.** Marusic, M.; Perkins, E.H. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Cellular Immunology ;* **62**: No. 1, 93-100(15 Jul 1981).

A single injection of irradiated Ehrlich ascites tumor (EAT) cells induces immunity in normal mice but fails to do so in T-cell-deficient-thymectomized, lethally irradiated, bone marrow-reconstituted (TIR) mice. TIR mice injected with normal syngeneic T cells develop an immune response to EAT when injected with irradiated EAT cells and reject a subsequent tumor cell challenge. In the present studies allogeneic T cells were unable to protect against EAT in TIR recipients even if harvested from donors tolerant to the recipient's transplantation antigens and injected into the TIR mice tolerant to the transplantation antigens of the injected T cells. Tolerance was produced by establishing long-term radiation chimeras of the $P \rightarrow F_1$ type. Semiallogeneic T cells also failed to afford protection against EAT in TIR recipients. Whereas tolerance to other parental-strain transplantation antigens did not reverse the inability of parental T cells (cells from $P \rightarrow F_1$ chimeric donors) to protect against EAT in $F_1$ TIR mice, it did enable $F_1$ T cells to afford protection in $P \rightarrow F_1$ TIR mice.

**33903 Factors affecting radionuclide availability to vegetables grown at Los Alamos.** White, G.C.; Hakonson, T.E.; Ahlquist, A.J. (Los Alamos National Lab., NM). Contract W-7405-ENG-36. *Journal of Environmental Quality ;* **10**: No. 3, 294-299(Jul 1981).

A field study was conducted in 1977 on $^{238,239}Pu$ and $^{137}Cs$ availability to zucchini squash (Curcurbita melopepo, hybrid seneca) and green bush beans (Phaseolus vulgaris, Landreths stringless) grown under home-garden conditions in an area at Los Alamos National Laboratory used for treated radioactive liquid waste disposal. Radionuclide concentrations were measured as a function of tissue type, height above the soil, fertilization regime, and for the squash, food-cleansing procedures. Analysis of variance procedures was used to analyze the data. Ratios of the concentration of a radionuclide in oven-dried vegetation to dry soil ranged from 0.0004 to 0.116 for the Pu isotopes, and from 0.051 to 0.255 for $^{137}Cs$. Fertilization with cattle manure reduced the Pu concentration ratios by 30% and $^{137}Cs$ by 50%. Vegetative parts sampled within 20 cm of the ground surface were contaminated about four times as much as those parts growing further from the ground surface. About 65% of the contamination was removed by washing, indicating the presence of surficial contamination. The 50-year radiation dose commitment to humans consuming vegetables from the garden plot would be less than 0.05 mrem and would be due almost entirely to $^{137}Cs$.

## 5603 Chemicals Metabolism And Toxicity

*REFER ALSO TO CITATION(S) 32960, 33843, 33919*

**33904** (CONF-800433—, pp 369-377) **Toxicokinetic studies possible after acute inhalation administration of compounds labeled with short-lived isotopes.** Kutzman, R.S.; Meyer, G.J.; Wolf, A.P. (Brookhaven National Lab., Upton, NY). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

A system has been developed to study the short term pharmacokinetics of inhaled organic pollutants after acute exposure of animals to near carrier free amounts of the radiolabeled compound. The agents tested were labeled with gamma emitting isotopes at very high specific activities. The decay characteristics of these isotopes allows the non-invasive measurement of the amount of radiolabel accumulated by the animal during the exposure period, as well as the amount retained at any time after exposure. Using a dynamic nose exposure apparatus rats were exposed to selected $^{11}C$-labeled compounds to demonstrate the utility of short-lived isotopes as unique new tracers for toxicokinetic studies of environmental agents.

**33905** (CONF-800433—, pp 388-397) **In vivo measurement of cadmium in an occupationally-exposed population.** Ellis, K.J.; Morgan, W.D.; Yasumura, S.; Vartsky, D.; Zanzi, I.; Cohn, S.H. (Brookhaven National Lab., Upton, NY). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Exposure to cadmium is recognized as a potentially serious health problem. A number of clinical abnormalities have been observed in workers occupationally exposed to cadmium. Therefore, it is essential that accurate data on body burdens be available in order to formulate dose-response relationships in man. This report describes the present Brookhaven facility for in vivo measurements of cadmium in man and recent results from a field study to a cadmium production plant. The cadmium content of the left kidney and concentration in the liver were measured by prompt-gamma neutron activation analysis in 82 occupationally exposed workers and 10 control subjects. Organ content ranged up to 57 mg in the kidney and up to 120 ppM in the liver for the industrial group. By contrast, the values for the control group ranged from 0.4 to 11.8 mg for the kidney and 0.7 to 7.9 ppM for the liver. The geometric means were 3.7 mg for the kidney and 2.7 ppM for the liver in the control group. When the data were analyzed to provide an estimate of the critical concentration for the kidney, a range of 300 to 400 $\mu g/g$ for the renal cortex was calculated. These results are compared with the available data in the literature.

**33906** (CONF-800433—, pp 415-423) **Nuclear magnetic resonance method for observation of ferromagnetic pulmonary contaminants.** Ettinger, K.V.; Vartsky, D.; Kronenberg, A.; Cohn, S.H. (Brookhaven National Lab., Upton, NY). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

A method is proposed for measurement of tissue concentration of asbestos and other contaminants containing magnetite. The method uses nuclear magnetic resonance (NMR) of protons as a means of detection of the magnetic particles present in the dust. Results of the study of the effect of concentration of iron particles and particle size on the NMR signal are presented. The NMR signal had linear relationship to the concentration particles. Experiments with different particle size indicated that the signal was proportional to the mass of particles rather than to their number. Quantitative detection of 7RF02 chrysotile asbestos in gel and in rat lungs was demonstrated.

**33907** (CONF-800433—, pp 512-523) **Analysis of fluorine contamination from industrial sources.** Skelly, J.M.; Furr, A.K.; Knight, H.G.; Parkinson, T.F. (Virginia Polytechnic Inst. and State Univ., Blacksburg). 1980. NTIS, PC A99/MF A01.

From 4. international conference on nuclear methods in environment and energy research; Columbia, MO, USA (14 Apr 1980).

Foilage samples from corn, pine trees, maple trees and grasses were collected in the vicinity of three industrial plants which process materials containing fluorides. The INAA method was used to measure the fluorine content of the foliage; concentrations ranged as high as 560 ppM (dry weight) in the foliage. Such levels clearly demonstrate that fluorine emissions from industrial plants can cause significant damage to field crops, ornamentals and trees.

33908 **(CONF-8009172—1) Variation in plant response to ozone: a conceptual model of physiological events.** Tingey, D.T.; Taylor, G.E. Jr. (Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.; Oak Ridge National Lab., TN (USA)). 1980. Contract W-7405-ENG-26. 47p. NTIS, PC A03/MF A01. Order Number DE81029692.

From 32. symposium on effects of gaseous air pollution in agriculture and horticulture; Nottingham, UK (1 Sep 1980).

The environment and genotype exert profound influences on a plant's ozone response. Based on the multiplicity of physiological mechanisms responsible for variable response, a common progression of events is proposed: ozone conductance (gas and liquid phase), perturbation, homeostasis, and injury. Injury is the repercussion of the preceeding events. Gas and liquid phase conductances are significant sources of variable ozone response. The importance of homeostasis is not well documented. Genic expression and environmental stimuli affect ozone conductance and homeostasis and thereby the extent of injury. Based on our conceptual model, gas phase conductance would be the decisive factor controlling injury only if it were the rate limiting step. Any physiologically significant intervening event between gas-phase conductance and injury would reduce the association between them. Either liquid phase conductance of homeostatsis could reduce that association. Because injury is not always associated with gas-phase conductance, this is prima-facie evidence that liquid phase conductance and homeostasis are important factors in controlling ozone response.

33909 **(DOE/ET/20512—T1) Studies on toxicity of OTEC plant components on marine animals from the Gulf of Mexico. Final report, September 1, 1978-November 30, 1980.** Venkataramiah, A.; Lakshmi, G.J.; Best, C.; Gunter, G.; Hartwig, E.; Wilde, P. (Gulf Coast Research Lab., Ocean Springs, MS (USA); Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract AS02-78ET20512. 126p. NTIS, PC A07/MF A01. Order Number DE81030167.

Ammonia and chlorine were chosen for toxicity studies as they pose the greatest potential environmental threat. Acute and chronic bioassays determined the $LT_{50}$, $LC_{50}$ and the behavior of mullet (Mugil cephalus), sargassum shrimp (Latreutes focorum) and filefish (Monocanthus hispidus). The chronic bioassays were carried out mainly in sublethal concentrations of ammonia and chlorine. The findings indicate that high concentrations of ammonia and chlorine from the OTEC plants are toxic to marine animals. Also the level of toxicity is related to the species, their habitats and life stages.

33910 **(EPRI-EA—1994(Vol.2)) Evaluation of CHESS: New York asthma data 1971 to 1972. Volume 2.** Roth, H.D.; Viren, J.R.; Pechan, E.H.; Ripps, A.E. (Flow Resources Corp., McLean, VA (USA); Roth Associates, Inc., Bethesda, MD (USA)). Aug 1981. 361p. NTIS, PC A16/MF A01. Order Number DE81904207.

A statistical reanalysis of the CHESS New York asthma data that were collected from 1971-72 is presented. An initial analysis of these data by the EPA suggested that asthma attacks increase with elevated levels of suspended nitrates in the ambient air environment. This analysis suffered from several shortcomings which raise serious questions about the study conclusions. For example, the original analysis failed to take into account factors such as day of study, a critical variable since daily attack rates declined appreciably as study periods grew longer. Other critical factors that were not considered in the EPA analysis were seasonal, psychological, and allergic effects as well as the lack of independence among asthma attacks. In addition, both the medical and the aerometry data in the study were of poor quality. The reanalysis attempted to compensate as much as possible for the various shortcomings. The results show no evidence of a link between suspended nitrates and asthma.

33911 (LBL—11986, pp 5.43-5.47) **Assessment of optimum microcosm design for pollution impact studies.** Harte, J.; Levy, D.; Rees, J.; Saegebarth, E. Feb 1981. NTIS, PC A04/MF A01. Order Number DE81028051.

In Environmental pollutant studies: FY 1980.

Laboratory microcosms may play an important role as experimental tools for examining ecological impacts resulting from human activities. The major advantage of microcosm studies over field research is that the former allow a greater opportunity for manipulation and control. In addition, the expense and environmental risk from microcosm investigations are relatively small compared to the risk from field studies of toxic substance effects. Studies carried out with freshwater lake microcosms during a four-year period in our laboratory have been directed mainly toward developing and evaluating microcosms as toxicological testing systems.

33912 **(ORNL—5721) Critical review of the mutagenic and other genotoxic effects of direct coal liquefaction.** Kimball, R.F.; Munro, N.B. (Oak Ridge National Lab., TN (USA)). Jul 1981. Contract W-7405-ENG-26. 216p. NTIS, PC A10/MF A01. Order Number DE81027859.

The purpose of this document is to review critically the information on the mutagenicity and other genotoxic effects of the developing direct coal liquefaction technology. The goal is to evaluate the potential health effects on humans and to make recommendations for action that might be taken to minimize them. The main conclusions are that the materials produced by direct coal liquefaction often contain a higher level of genotoxic compounds than comparable materials from other liquid fossil fuel technologies, that combined chemical and biological assay has made possible considerable progress in identifying the chemical substances responsible for this difference, and that there are ways to modify the technology that might eliminate many if not all of these genotoxic compounds. The review consists of six chapters. The first three are essentially introductions to genotoxicity testing and to the theories back of it, to the technology of direct coal liquefaction, and to the chemistry involved in analyzing and preparing for biological testing of the materials from the technology. The fourth chapter concerns tests for genotoxicity of the compounds and compound classes that have been identified by chemical analysis as present in such materials. The fifth chapter concerns tests for genotoxicity of the materials from the technology. The final chapter summarizes the conclusions that can be drawn from these tests and makes recommendations concerning future research and other activities to define better and to minimize the potential genotoxic effects of the technology.

33913 **(PNL-SA—9435) Epidemiological approaches to reproductive hazards of the workplace.** Sever, L.E. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1981. Contract AC06-76RL01830. 11p. (CONF-8106154—1). NTIS, PC A02/MF A01. Order Number DE81030069.

From 1981 March of Dimes Birth Defects conference; San Diego, CA, USA (15 Jun 1981).

Much current concern grows out of a lack of knowledge of potential reproductive hazards of the workplace. This paper discusses epidemiologic approaches to studying effects of embryonic-fetal exposure. Considered are study designs used, some of the pregnancy outcomes of concern, determination of exposures, and regulatory activities. (ACR)

33914 **Method of determining glass in rat lung after exposure to a glass fiber aerosol.** Griffis, L.C.; Henderson, T.R.; Pickrell, J.A. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM). Contract AC04-76EV01013. *American Industrial Hygiene Association Journal* ; 42: No. 8, 566-569(Aug 1981).

Ihnalation toxicology studies of glass fibers require a knowledge of the dose deposited in the lungs of exposed animals. A method is described which uses the quantity of acid-insoluble sodium present in rat lungs to determine the lung burdens of glass by mass after exposure to glass fiber aerosol. This sodium was measured in lung homogenates after acid washing and fusion in $Li_2CO_3$. Results of an in vitro dissolution study indicated that a portion of the sodium present in the glass fibers was dissolved a a faster rate than the glass itself. This preferential dissolution may result in a small underestimation of glass in lung. This method was used to determine lung burdens of glass in rats after 1, 2, 4 or 5 exposures to a glass fiber aerosol. Five 6-hour exposures at an average concentration of 47 mg/m$^3$ resulted in a lung burden of 176 $\mu$g of glass. It was estimated that 41 to 8% of the lung burden was cleared between daily exposures.

33915 **Comparative toxicity of hypochlorous acid and hypochlorite ions to mosquitofish.** Mattice, J.S.; Tsai, S.C.; Burch, M.B. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Transactions of the American Fisheries Society ;* **110**: No. 4, 519-525(Jul 1981).

We examined the relative toxicity of hypochlorous acid (HOCl) and the hypochlorite ion ($OCl^-$) by exposing mosquitofish Gambusia affinis for 1 hour to predominantly free residual chlorine (FRC) at six levels of pH following a 7-day acclimation to the test pH. Median lethal concentrations (LC50), in terms of total residual chlorine (TRC), increased with increasing pH. Because of the influence of hydrogen ion concentration on dissociation of HOCl, the percent of FRC present as HOCl is about 97% and 13%, respectively, at the low and high pH. Cursory examination of toxicity of monochloramine ($NH_2Cl$) and mixtures of $NH_2Cl$ and dichloramine ($NHCl_2$) suggested that their contributions to toxicity were negligible at any test pH. Free residual chlorine concentrations at the LC50 for each pH were fitted to a theoretical model derived from an assumption that toxicities of HOCl and $OCl^-$ were additive.

## 5604 Other Environmental Pollutant Effects

*REFER ALSO TO CITATION(S) 33046*

33916 (DOE/EP/10012—1, pp 46-49) **Noise.** Jun 1981. NTIS, PC A06/MF A01.

In Energy and environmental quality: case histories of impact management.

Noise is an environmental pollutant because of its psychological and other health effects. Energy source development through construction and transportation means are prime contributors to this problem. Case studies and their relevance to environmental impacts are discussed. (DLS)

33917 **Effects of light on biomass and community structure of estuarine detrital microbiota.** Bobbie, R.J.; Nickels, J.S.; Smith, G.A.; Fazio, S.D.; Findlay, R.H.; Davis, W.M.; White, D.C. (Florida State Univ., Tallahassee). *Applied and Environmental Microbiology ;* **42**: No. 1, 150-158(Jul 1981).

Comparison of estuarine detrital microbiota grown with and without light in the absence of macroscopic grazing showed shifts in the community structure that enabled correlation between various biochemical measures. Analysis of these biochemical measures showed that growth in light induces the smallest increases in procaryotic attributes such as muramic acid; wall glucosamine; lipid phosphate; total extractable adenosine nucleotides; short-branched, cyclopropane, and cis-vaccenic fatty acids; lipid glucose and mannose; the incorporation of acetate into lipid; and the formation of deoxyribonucleic acid from thymidine. Measures of the microfauna such as lipid inositol and the γ-linolenic series of polyenoic fatty acids also increased minimally in the light-grown microbiota. Measures of sulfolipid synthesis, lipid glycerol, total extractable palmitate, 18-carbon polyenoic fatty acids, and total polyenoic fatty acids longer than 20 carbons increased to 10- to 15-fold in algae and fungi. Chlorophyll a, lipid galactose, and the 16- and 20-carbon polyenoic fatty acids characteristic of diatoms increased maximally in the light. This increase of diatom measure correlated with the sheets of diatoms detected by scanning electron microscopy.

# 57 HEALTH AND SAFETY

33918 **(DOE/ID/01375—T1) Management Oversight and Risk Tree - MORT.** Johnson, W.G. (Aerojet Nuclear Co., Scoville, ID (USA)). 12 Feb 1973. Contract AC07-76ID01375. 571p. (SAN—821-2). NTIS, PC A24/MF A01. Order Number DE81028079.

A management Oversight and Risk Tree (MORT) was designed to provede a technique for thorough, searching investigation of occupational accidents and analysis of safety programs. MORT has been used to improve safety in specific activities and in already low accident rates or probabilities. MORT is a formal, disciplined logic or decision tree to systematically relate and integrate a wide varity of safety concepts. Trials of MORT have shown an ability to assist persons from a discipline - safety, management, engineering, sciences or other staff specialities and experienced craftsmen - to quickly apply and broaden their skills in accident analysis and safety review, and have provided a common base for communication, cooperation, and planning for greater accident control. At the same time, the disciplined MORT format has shown flexibility in rapid evaluation and assimilation of new experience, judgment, findings or technology. Specific safety innovation and acceptance methods and projects have been outlined for transition to a comprehensive, superlative safety system.

33919 **(K/RA—106) Working with asbestos.** Headrick, L.A.; Duncan, D.T. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 15 May 1981. Contract W-7405-ENG-26. 21p. (CONF-8105110—1). NTIS, PC A02/MF A01. Order Number DE81029862.

From 1981 american industrial hygiene conference; Portland, OR, USA (24 May 1981).

Adverse health effects associated with the overexposure to airborne asbestos fibers are asbestosis, a nonmalignant scarring of lung tissue, mesothelioma, and respiratory cancer. Controls used to prevent excessive exposure to airborne asbestos fibers are discussed and illustrated. (JGB)

33920 **(SAND—81-0632) Guidance for implementing an Environmental, Safety, and Health Assurance Program. Volume I. A model plan for Institutional Environmental, Safety, and Health Assurance Programs.** Trauth, C.A. Jr.; Ellingson, A.C.; Marston, K. (Sandia National Labs., Albuquerque, NM (USA); Tech. Reps., Inc., Albuquerque, NM (USA)). Jun 1981. Contract AC04-76DP00789. 38p. NTIS, PC A03/MF A01. Order Number DE81029315.

This is the first of 15 documents designed to illustrate how an Environmental, Safety, and Health (ES and H) Assurance Program may be implemented. The generic definition of ES and H Assurance Programs is given in a companion document entitled An Environmental, Safety, and Health Assurance Program Standard. This particular document presents a model institutional level ES and H Assurance Program which may be used as a guide by an institution in developing its own plan. Such a plan provides the basic definition of the organizational structure and program form for the total institutional ES and H Assurance Program and thus serves as the starting point for all ES and H activities.

33921 **(SAND—81-0645) Guidance for implementing an environmental, safety and health assurance program. Volume 14. Model guidelines for utilizing quality assurance support in environmental, safety and health assurance programs.** Ellingson, A.C. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 66p. NTIS, PC A04/MF A01. Order Number DE81031931.

This is 1 of 15 documents designed to illustrate how an Environmental, Safety and Health (ES & H) Assurance Program may be implemented. The generic definition of ES & H Assurance Programs is given in a companion document entitled An Environmental, Safety and Health Assurance Program Standard. Since the quality of material, equipment, or facilities affects the realization of hazard consequences, this document provides guidance for using the traditional Quality Assurance Program as one aspect of the ES & H Assurance Program. An assurance program is essentially a management system which consists of a control subprogram and a verification subprogram. The control subprogram includes: identification of primary objective(s); analysis of the primary objective(s) to obtain subpart(s) and identify the factors which determine the subpart(s); determination of controls for these factors; establishment of a system for implementing these controls; and implementation of the system. The verification subprogram involves the review, audit, test, and measurement functions which ensure that the control subprogram is adequate and used. In ES & HA Programs, the control over the hardware (facilities, material, and equipment) risk factors is to a large extent identical to the control exercised by a QA program. To avoid duplication of effort, it is recommended that control in this area be systematically delegated to the QA program with appropriate coordination by the ES & H Staff. The description of a QA program presented in this guideline document is intended to facilitate such a cooperative endeavor.

# 58 GEOSCIENCES

## 5801 Geology And Hydrology

*REFER ALSO TO CITATION(S) 32896, 32897, 32898, 32986, 32991, 33047, 33053, 33054, 33210, 33212, 33213*

**33922** (LBL—11566, pp 111-114) **Development of an explicit finite-difference fluid flow model.** Hofmann, R. (Science Applications Inc., San Leandro, CA). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

An explicit hydrological model has been developed and coupled to the STEALTH 2D code. It has been successfully tested in the uncoupled mode and is currently under further testing. This paper presents some preliminary results.

**33923** **(PNL-SA—9478) Analysis of column tracer experiments by a stochastic-convective transport method.** Simmons, C.S. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1981. Contract AC06-76RL01830. 30p. (CONF-810761—1). NTIS, PC A03/MF A01. Order Number DE81030088.

From AGU chapman conference on spatial variability in hydrology; Fort Collins, CO, USA (21 Jul 1981).

Recent research into the mechanisms of solute transport in porous media on a field-length scale has indicated that a transport description in terms of a stochastic-convective flow equation provides a more adequate approach than the conventional convection-dispersion equation, because the latter equation fails to describe transport in hydrogeologic systems for which hydrodynamic dispersion is non-Fickian. Stochastic transport methods require prior estimation of a statistical mean and spatial covariance of the flow velocity, instead of a dispersive parameter. A stochastic-convective transport formulation based upon solute travel time probability is presented and is shown to include Fickian transport as a special subcase. It is further demonstrated that a travel time probability associated with a log-normal distribution of hydraulic conductivity will yield concentration breakthrough curves nearly equivalent to Fickian transport when the coefficient of variation in travel time is sufficiently small. ($\leqq 1$). Applied to column tracer experiments the results suggest that typical laboratory measured hydrodynamic dispersion may be ascribed to local variations in hydraulic conductivity. The travel time formulation is shown to provide a direct link between measured dispersivity and the autocovariance of local flow velocity variation, which can be a consequence of media inhomogeniety and the system boundary conditions. Dispersivity is shown to manifest a scale effect by increasing in proportion to the length of a system when the velocity correlation range is greater than the length. Chemical absorption effects are described by simply scaling the travel time probability with a retardation factor.

## 5802 Geophysics

*REFER ALSO TO CITATION(S) 33029, 33030, 33031, 33033, 33348, 33720*

**33924** (DPST—81-262, pp 6p, Paper 1) **Earthquake damage to underground facilities.** Pratt, H.R. (Terra Tek, Inc., Salt Lake City, UT); Stephenson, D.E.; Zandt, G.; Bouchon, M.; Hustrulid, W.A. 1981. NTIS, PC A06/MF A01.

In Workshop on seismic performance of underground facilities, February 11-13, 1981, Augusta, Georgia.

Analytical models were used to determine relative displacements of shafts and near-surface displacement of large rock masses. Numerical methods were used to determine the displacement fields associated with pure strike-slip and vertical normal faults. Results are presented as displacements for various fault lengths as a function of depth and distance. This provides input to determine potential displacements in terms of depth and distance for underground facilities, important for assessing potential sites and design parameters. 9 figures.

**33925** (DPST—81-262, pp 5p, Paper 2) **Damage to underground structures during earthquakes.** McClure, C.R. (Bechtel Civil and Minerals, Inc., San Francisco, CA). 1981. NTIS, PC A06/MF A01.

In Workshop on seismic performance of underground facilities, February 11-13, 1981, Augusta, Georgia.

During the course of studies for various types of underground facilities data on the behavior of underground structures during earthquakes have been collected and reviewed. These studies have included underground facilities such as tunnels, underground power houses, nuclear waste repositories, and underground nuclear power plants. The data presented are concerned chiefly with tunnels and mines in rock.

**33926** (DPST—81-262, pp 6p, Paper 4) **Importance of joint parameters on deformations observed in dynamically loaded models of large excavations.** Barton, N. (Terra Tek, Inc., Salt Lake City, UT). 1981. NTIS, PC A06/MF A01.

In Workshop on seismic performance of underground facilities, February 11-13, 1981, Augusta, Georgia.

The deformation and instability observed in dynamically loaded physical joint models are summarized, and the effect of joint parameters mentioned. Recent work on joint strength and stiffness scale effects is summarized. Suggestions are made for modifying and improving some of the joint parameters used in SAI's numerical JOINT SLIP and CAVS Tensile Failure models.

**33927** (DPST—81-262, pp 5p, Paper 5) **Computation of seismic wave fields and soil-structure interaction.** Lysmer, J. (Univ. of California, Berkeley). 1981. NTIS, PC A06/MF A01.

In Workshop on seismic performance of underground facilities, February 11-13, 1981, Augusta, Georgia.

Purpose of this lecture is to review the current state-of-the-art of seismic soil-structure interaction analysis. Many of the results obtained from the studies of surface structures can be directly applied to underground structures. This lecture attempts to facilitate this transfer by discussing some of the generic problems of soil-structure interaction and some available, and soon to become available, analytical procedures.

**33928** (LBL—11566, pp 65-76) **Modeling of groundwater flow in fractured rocks for radioactive waste repository studies.** Burgess, A.S. (Acres American Inc., Buffalo, NY); Ratigan, J.L. Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

Groundwater modeling represents only a part of the complete analysis which is required to define the effects of release of radionuclides and the dose commitment resulting to man. Other factors important in contaminant transport include dispersion, sorption of various species, reaction between the various species and the fractured media, release rate, dilution, and uptake into the food chain and the pathway to man. Besides the geologic barrier, engineering barriers must also be taken into account, including the waste form, cannister, overpack, and any other backfill material. In the studies reported, only freshwater was considered. Density effects due to thermal heating were included, but those due to groundwater geochemistry were neglected because of the lack of data. Recent drilling in the Canadian Precambrian Shield, however, has indicated that saline groundwaters do occur at depth. Future modeling should, therefore, include the effect of natural density differences. The siting potential of largely static saline groundwaters, for example, in crystalline rocks beneath sedimentary sequences, requires further research. The principal needs at present are for more field data on permeability and flow porosity, and the opportunity to test models against realistic field conditions. Further analytical refinement at this time is of lesser importance.

### 5803 Mineralogy, Petrology, And Rock Mechanics

*REFER ALSO TO CITATION(S) 32915, 32916, 32992, 33037, 33038*

33929 (LBL—11566, pp 43-49) **Finite element method for coupled stress and fluid flow analysis of fractured rock masses.** Noorishad, J.; Ayatollahi, M.S.; Witherspoon, P.A. (Lawrence Berkeley Lab., CA). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

Following a delineation of the constitutive and governing equations of fluid flow through deformable fractured rock masses, a Gurtine-type variational formulation for general initial and boundary fluid flow and load deformation conditions as well as fluid body forces is presented. Subsequent finite-element discretization offers a numerical technique capable of analyzing quasi-static stress and fluid flow behavior of deformable fractured rock masses. The method is verified and applied with the help of a few examples.

33930 (LBL—11566, pp 60-64) **Detection of fractures from well testing.** Pahwa, S.B.; Baxley, P.T. (Intera-Environmental Consultants, Inc., Houston, TX). Sep 1980. NTIS, PC A07/MF A01. Order Number DE81029947.

From Workshop on numerical modeling of thermohydrological flow in fractured rock masses; Berkeley, CA, USA (19 Feb 1980).

General conclusions that can be drawn from the interpretation of these tests are as follows: (1) interpretation of single well slug and recovery tests can be done more accurately by matching both water level and flow rate instead of matching only water level as is done in conventional interpretation methods; (2) the numerical method of slug and recovery test interpretation described in this paper can be used to determine existence of fractures; (3) this method cannot be used to characterize fractures in terms of determining orientation, spacing, width, and length. If fractures are determined by this method, other tests are needed to characterize fractures; (4) the Magenta dolomite and Culebra dolomite in the vicinity of the two wells definitely give indications of being fractured.

33931 (LBL—12987) **Program ROCMAS: introduction and user's guide.** Noorishad, J.; Ayatollahi, M.S. (Lawrence Berkeley Lab., CA (USA)). Sep 1980. Contract W-7405-ENG-48. 74p. NTIS, PC A04/MF A01. Order Number DE81030232.

This model is for the study of coupled fluid flow and stress in deformable fractured rock masses. The effective mass theory of Biot is used to relate the pressure changes with the displacements of the rock matrix. The deformation of the fracture surfaces in turn affects the fracture flow through the sensitive dependence of permeability on aperture. The code combines techniques of fluid flow modeling and stress-strain analysis. The model is based on general theory which is of fundamental interest and practical importance. The code has the capability of handling a range of complex problems in fluid flow, induced rock mass deformation and soil consolidation. Further developments to couple the fluid flow with heat transfer, or to incorporate dynamic stress analysis, can increase the range of applicability. More extensive application of the code is called for.

33932 (SAND—81-1271) **Circumferential stresses and crack opening displacements at a fractured well bore.** Warren, W.E.; Martinez, P.F. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 46p. NTIS, PC A03/MF A01. Order Number DE81030985.

Results of a plane strain analysis of the circumferential stresses around the wall of a fractured borehole and the associated crack opening displacements are presented. These borehole stresses are of considerable interest in at least two geologic applications involving the possibility of forming multiple fractures at boreholes and the measurement of in-situ stresses. For short cracks, the borehole stresses near the crack are shown to become highly compressive over a large region of the borehole. As the crack grows, the magnitude of this stress decreases but remains compressive over a larger angle around the borehole. These fracture induced stresses effectively clamp the borehole in compression and prohibit additional crack initiation and growth under quasi-static loading conditions. It it also clear that these compressive stresses and associated strains must be accounted for in any stress-relieving technique utilized for the investigation of in-situ stresses.

### 5804 Geochemistry

*REFER ALSO TO CITATION(S) 33001, 33013*

## 64 PHYSICS RESEARCH

### 6401 Astrophysics And Cosmology

*REFER ALSO TO CITATION(S) 33691*

33933 **Full amplitude models of 15 day Cepheids.** Cogan, B.C.; Cox, A.N. (Los Alamos Scientific Lab., NM (USA)); King, D.S. (New Mexico Univ., Albuquerque (USA)). *Space Science Reviews ;* **27**: No. 3/4, 419-424(Nov-Dec 1980).

Numerical models of Cepheids have been computed with a range of effective temperatures and compositions. The amplitudes increase if the helium abundance increases or if the effective temperature decreases. The latter effect is contrary to observational data. The models also exhibit velocity amplitudes which are much lower than those observed.

33934 (LA-UR—81-2505) **Neutrino number of the universe.** Kolb, E.W. (Los Alamos National Lab., NM (USA)). 10 Aug 1981. Contract W-7405-ENG-36. 11p. (CONF-8106156—1). NTIS, PC A02/MF A01. Order Number DE81030249.

From International conference on neutrino physics and astrophysics; Maui, HI, USA (30 Jun 1981).

The influence of grand unified theories on the lepton number of the universe is reviewed. A scenario is presented for the generation of a large ($>> 1$) lepton number and a small ($<< 1$) baryon number. 15 references.

33935 (LA-UR—81-2575) **Supernova hydrodynamics.** Colgate, S.A. (Los Alamos National Lab., NM (USA); New Mexico Inst. of Mining and Technology, Socorro (USA)). 1981. Contract W-7405-ENG-36. 8p. (CONF-810870—1). NTIS, PC A02/MF A01. Order Number DE81030243.

From Plasma astrophysics course and workshop; Varenna, Italy (27 Aug 1981).

The explosion of a star supernova occurs at the end of its evolution when the nuclear fuel in its core is almost, or completely, consumed. The star may explode due to a small residual thermonuclear detonation, type I SN or it may collapse, type I and type II SN leaving a neutron star remnant. The type I progenitor should be thought to be an old accreting white dwarf, 1.4 M/sub $\theta$/, with a close companion star. A type II SN is thought to be a massive young star 6 to 10 M/sub $\theta$/. The mechanism of explosion is still a challenge to our ability to model the most extreme conditions of matter and hydrodynamics that occur presently and excessively in the universe. 39 references.

33936 (LA-UR—81-2591) **Ion chamber gamma burst detector.** Colgate, S.A. (Los Alamos National Lab., NM (USA)). 25 Aug 1981. Contract W-7405-ENG-36. 9p. (CONF-810871—1). NTIS, PC A02/MF A01. Order Number DE81030240.

From Workshop on gamma ray transients and related astrophysical phenomena; La Jolla, CA, USA (5 Aug 1981).

A gamma ray burst detector of x-ray photons 2 to 10 keV is designed to maximize area, 100 $m^2$, and sensitivity, $10^{-10}$ ergs $cm^{-2}$ s/sup 1/2/ modest directionality, 2 x $10^{-4}$ sr, and minimize thickness, 3 mg $cm^{-2}$, as a plastic space balloon ion chamber. If the log N - log S curve for gamma bursts extends as the -3/2 power, the sensitivity is limited by gamma-burst peak overlap in time so that the question of the size spectrum and isotropy is maximally tested. Supernova type I prompt x-ray bursts of congruent to 3-ms dura-

tion should be detected at a rate of several per day from supernova at a distance greater than 100 Mpc.

33937 **Spectral evolution of the 5 March 1979 γ burst.** Fenimore, E.E.; Evans, W.D.; Klebesadel, R.W.; Laros, J.G.; Terrell, J. (Los Alamos Scientific Lab., NM (USA)). *Nature (London) ;* **289**: No. 5793, 42-43(Jan 1981).

Spectral observations of the γ burst of 5 March 1979, and of the X-ray pulsar which was apparently triggered by the burst, are analysed. These observations, in the range 50-1,000 keV, had sufficient time resolution to resolve spectral changes within the main burst. It is postulated that, although the source is probably a neutron star with an obliquely rotating magnetic field, simple cooling of residual hot spots does not completely explain the recorded pulsations.

33938 **Evidence for planetary progenitor rotation and for the long term acceleration of the ejected nebular shell.** Kirkpatrick, R.C. (Los Alamos Scientific Lab., NM (USA)). *Space Science Reviews ;* **27**: No. 3/4, 467-472(Nov-Dec 1980).

Several theories seek to explain the peculiar shapes of planetary nebulae. Those of Louise, Kirkpatrick, and Phillips and Reay rely on progenitor rotation. The velocity-radius relation for the shells of well observed planetaries do not extrapolate back through the origin, but rather fall short, suggesting that the shell acquires its velocity over a significant period of time. Kirkpatrick's theory relies heavily on long term acceleration of the nebular shell, and other theoretical studies support the idea of acceleration of the nebular shell up to the time it becomes optically thin to the ionizing radiation from the central star.

33939 **RR Lyrae and BL Herculis variables.** Cox, A.N. (Los Alamos Scientific Lab., NM (USA). Theoretical Div.). *Space Science Reviews ;* **27**: No. 3/4, 475-481(Nov-Dec 1980).

The RR Lyrae variables are currently believed to have masses between about 0.5 and 0.8 Msub(sun), effective surface temperatures between 6350 and 7500K, radii from about 4.0 to 6.0 Rsub(sun) and luminosities between log L/Lsub(sun) of 1.5 and 2.0. Since they are found in population II locations, they generally have $Y = 0.3$ and $Z = 10^{-3}$, but there are exceptions for both higher Z like the sun and lower Z like 0.0002. In globular clusters the periods range from 0.25 - 0.45 day for the first overtone pulsators and 0.40 - 0.80 day for those in the fundamental mode, depending on their luminosity. At transition lines, to be discussed in detail below, the switch from fundamental to first overtone, or maybe vice versa, involves a period change factor of about 0.74-0.75.

33940 **Low-mass evolution from He ignition to beyond the horizontal branch.** Despain, K. (Haverford Coll., PA (USA). Dept. of Astronomy; Los Alamos Scientific Lab., NM (USA). Theoretical Div.). *Space Science Reviews ;* **27**: No. 3/4, 483-489(Nov-Dec 1980).

The evolution of an 0.6 Msub(sun) stellar model during core helium burning is presented. Following the off-center ignition of helium in the core flash, the star remains on the red giant branch for $> 10^6$ years, undergoing twelve additional flashes. After leaving the giant branch, the star evolves on the horizontal branch for $8.15 \times 10^7$ years before returning to the giant branch and undergoing strong helium-shell flashes. The implications for horizontal branch and RR Lyrae stars are discussed.

33941 **Core helium flash.** Cole, P.W. (Boston Univ., MA (USA). Dept. of Astronomy); Denpree, R.G. (Boston Univ., MA (USA). Dept. of Astronomy; Los Alamos Scientific Lab., NM (USA)). *Space Science Reviews ;* **27**: No. 3/4, 491-493(Nov-Dec 1980).

The role of convection in the core helium flash is simulated by two-dimensional eddies interacting with the thermonuclear runaway. These eddies are followed by the explicit solution of the 2D conservation laws with a 2D finite difference hydrodynamics code. Thus, no phenomenological theory of convection such as the local mixing length theory is required. Our core helium flash is violent, producing a deflagration wave. This differs from the detonation wave (and subsequent disruption of the entire star) produced in previous spherically symmetric violent core helium flashes as the second dimension provides a degree of relief which allows the expansion wave to decouple itself from the burning front. Our results predict that a considerable amount of helium in the core will be burned before the horizontal branch is reached and that some envelope mass loss is likely.

33942 **Nonlinear calculations for BL Her stars.** Hodson, S.W.; Cox, A.N. (Los Alamos Scientific Lab., NM (USA). Theoretical Div.); King, D.S. (New Mexico Univ., Albuquerque (USA). Dept. of Physics and Astronomy). *Space Science Reviews ;* **27**: No. 3/4, 503-508(Nov-Dec 1980).

BL Herculis stars are of particular interest because they are frequently observed to have light curve bumps on increasing or decreasing light. These bumps appear to follow a Hertsprung progression much like the more massive classical bump Cepheids. Consequently, they may have the same mechanism, either echos from the stellar center, or a near resonance between the fundamental (period $P_{I_0}$) and second overtone (period $P_{I_2}$) radial pulsation modes where $P_{I_2}/P_{I_0}$ approx. equals 0.50 +- 0.03. This resonance hypothesis based on nonlinear calculations of Stobie predicts bumps before maximum light for $P_{I_2}/P_{I_0} < 0.50$, and bumps after maximum light for $P_{I_2}/P_{I_0} > 0.5$.

33943 **Pulsations of the R Coronae Borealis stars.** Cox, J.P.; Wheeler, J.C.; Hansen, C.J. (Colorado Univ., Boulder (USA). Joint Inst. for Laboratory Astrophysics; National Bureau of Standards, Boulder, CO (USA)); King, D.S. (New Mexico Univ., Albuquerque (USA)); Cox, A.N.; Hodson, S.W. (Los Alamos Scientific Lab., NM (USA)). *Space Science Reviews ;* **27**: No. 3/4, 529-535(Nov-Dec 1980).

The radial pulsations of very luminous, low-mass models (L/M approx. $10^4$ solar units), which are possible representatives of the R CrB stars, have been examined. These pulsations are extremely nonadiabatic. We find that there are in some cases at least one extra ( strange ) mode which makes interpretation difficult. The blue instability edges are also peculiar in that there is an abrupt excursion of the blue edge to the blue for L/M sufficiently large. The range of periods of the model encompasses observed periods of the Cepheid-like pulsations of actual R CrB stars.

33944 **Core collapse, bounce and shock propagation.** Bowers, R.L.; Wilson, J.R. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Space Science Reviews ;* **27**: No. 3/4, 537-544(Nov-Dec 1980).

Recent developments in the physics input for iron core collapse models of type II supernovae are reviewed. The effect of these developments on collapse calculations is also discussed. The inner core collapses homologously, with little change in specific entropy, bounces in the neighborhood of nuclear density, and sets up an outward moving shock. In adiabatic models an explosion may result. The inclusion of neutrino effects may produce substantial shock damping. Current results indicate that core collapse, bounce and shock propagation does not produce an explosion when neutrino effects are included.

33945 **Effect of rotation on the hydrodynamics of stellar collapse.** Tohline, J.E. (Los Alamos Scientific Lab., NM (USA)); Schombert, J.M. (Yale Univ., New Haven, CT (USA). Observatory); Boss, A.P. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). *Space Science Reviews ;* **27**: No. 3/4, 555-561(Nov-Dec 1980).

To date, most of the hydrodynamic calculations that have followed the details of the physics during an iron core collapse have been restricted to spherical symmetry and therefore have neglected the role that rotation may play in the hydrodynamics of the collapse. If rotation is important, the core will flatten to an oblate spheroidal shape allowing some loss of energy through gravitational radiation; the core could conceivably dynamically evolve to a toroidal configuration as has been observed in some models of rotating protostellar clouds; and it may, through a rotational instability, eventually evolve into a non-axisymmetric structure. It is important to know just how much rotational energy must be present in the pre-collapse core in order for these, or any other significant deviations from spherical symmetry, to become important considerations during a core collapse.

33946 **Supernova explosions - the role of a Rayleigh-Taylor instability.** Buchler, J.R. (Florida Univ., Gainesville (USA). Dept. of Physics); Livio, M. (Florida Univ., Gainesville (USA). Dept. of Physics; Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy); Colgate, S.A. (Los Alamos Scientific Lab., NM (USA). Group T-6). *Space Science Reviews ;* **27**: No. 3/4, 571-577(Nov-Dec 1980).

A two dimensional hydrodynamic study indicates that convectively unstable gradients which develop during core collapse and bounce give rise to large scale core overturn. It is also shown that the concomitant release of neutrinos can deposit large amounts of energy and momentum in the infalling envelope and give rise to a powerful supernova explosion.

33947 **Effect of stellar structure on supernova remnant evolution.** Jones, E.M.; Smith, B.W. (Los Alamos Scientific Lab., NM (USA)); Straka, W.C. *Space Science Reviews ;* **27**: No. 3/4, 579-584(Nov-Dec 1980).

One-dimensional hydrodynamic calculations have been done of 1E51 erg explosions in 15Msub(sun) stars. We have appended a steep external density gradient to the pre-supernova model of Weaver et al. and find: (1) the outer shock wave decelerates throughout the pre-Sedov phase, (2) the expanding stellar envelope and the shocked interstellar material are Rayleigh-Taylor stable until the Sedov phase, and (3) steep internal density gradients are R-T unstable during the early expansion and may be the source of high velocity knots seen in Cas A.

33948 **One dimensional hydrodynamics of asteroid-neutron star collisions.** Newman, M.J.; Cox, A.N. (Los Alamos Scientific Lab., NM (USA)). *Space Science Reviews ;* **27**: No. 3/4, 591-594(Nov-Dec 1980).

It has been suggested by several authors that the observed cosmic gamma-ray bursts might be produced by the collision of comet or asteroid-sized bodies with a compact object. Colgate and Petschek have discussed the tidal breakup of a solid body approaching a neutron star in central impact, with particular application to the cosmic gamma-ray burst of March 5, 1979. In this work we present the results of simplified one-dimensional hydrodynamic-radiation diffusion calculations of such an occurence.

33949 **New instability strip for hot degenerates.** Starrfield, S.G. (Arizona State Univ., Tempe (USA)); Cox, A.N.; Hodson, S.W. (Los Alamos Scientific Lab., NM (USA). Theoretical Div.). *Space Science Reviews ;* **27**: No. 3/4, 621-626(Nov-Dec 1980).

A completely new kind of variable star has recently been discovered (McGraw, et al. 1979). Designated as PG1159-035 (hereafter PG) this star is distinguished not only by the complete lack of hydrogen in its spectrum but also by an effective temperature that exceeds 8 x $10^4$ K (McGraw, private communication). The photometric data show that this star is pulsating with two periods - 539 seconds and 460 seconds and the light curve is very reminiscent of that of a ZZ Ceti variable star (DA white dwarfs pulsating in non-radial modes). However, its spectral characteristics show that it cannot be included in this class since analysis of both optical and IUE spectra show that the major atmospheric constituents are probably helium and carbon and that its surface gravity is considerably lower than $10^8$ cm $sec^{-2}$ characteristic of a DA white dwarf. Its energy distribution suggests a small amount of reddening and, since it is far out of the plane, it must be at a distance at least 1 kpc.

33950 **Hydrodynamic studies of the nova outburst.** Starrfield, S. (Arizona State Univ., Tempe (USA). Dept. of Physics; Los Alamos Scientific Lab., NM (USA). Theoretical Div.). *Space Science Reviews ;* **27**: No. 3/4, 635-640(Nov-Dec 1980).

Over the past few years, significant advances have been made in our understanding of the nova outburst. The theoretical studies have shown not only that a thermonuclear runaway in the envelope of a white dwarf reproduces the gross features of the nova outburst, but also made important predictions regarding the observed behavior of the outburst itself. The observational studies have provided us with new data concerning the evolution of the bolometric light curve of a nova during outburst, the elemental abundances in the ejecta, the formation of dust during the outburst, and the structure of nova binaries.

33951 **Fermi acceleration revisited.** Lichtenberg, A.J.; Liebermann, M.A. (California Univ., Berkeley (USA)); Cohen, R.H. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Physica D: Nonlinear Phenomena (Amsterdam) ;* **1**: No. 3, 291-305(Sep 1980).

Mappings that have been used to describe the Fermi acceleration mechanism are examined. It is shown that results which appear to be contradictory are due to differences in the mapping equations. For those mappings that can be locally approximated by the standard mapping, the value of the nonlinear parameter of the standard mapping, for which the last isolating KAM surface exists, can be used to predict the loss of KAM stability with action for the more general mappings. Previous results of the density distribution in the stochastic region of the phase space, averaged over phases, is shown to be consistent with the ergodic hypothesis. Fine scale structure of the mappings is found to be model dependent. The standard mapping is a member of a class of mappings which retains some KAM trajectories at arbitrarily large nonlinearity.This feature is not generic to a wider class of mappings discussed in this paper. The stability of two-iteration fixed points are discussed in detail, including the bifurcation sequence for one type of mapping.

## 6402 Atmospheric Physics

33952 **(UCID—19185) Summary of the LLNL one-dimensional transport-kinetics model of the troposphere and stratosphere: 1981.** Wuebbles, D.J. (Lawrence Livermore National Lab., CA (USA)). Sep 1981. Contract W-7405-ENG-48. 29p. NTIS, PC A03/MF A01. Order Number DE81030480.

Since the LLNL one-dimensional coupled transport and chemical kinetics model of the troposphere and stratosphere was originally developed in 1972 (Chang et al., 1974), there have been many changes to the model's representation of atmospheric physical and chemical processes. A brief description is given of the current LLNL one-dimensional coupled transport and chemical kinetics model of the troposphere and stratosphere.

## 6403 Atomic, Molecular, And Chemical Physics

*REFER ALSO TO CITATION(S) 33496, 33569, 34180*

33953 **(BNL—29798) Slow positrons in the study of surface and near-surface defects.** Lynn, K.G. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 54p. (CONF-810756—1). NTIS, PC A04/MF A01. Order Number DE81030027.

From International school of physics position in solids conference; Lake Como, Italy (14 Jul 1981).

Slow positron studies are reviewed with an emphasis on their capabilities in extracting defect information in the near-surface region under a variety of experimental conditions. A general theoretical model is presented which includes the probability of a positron diffusing back to the surface after implantation, and thermalization in samples containing various defects. This model incorporates surface processes such as direct reemission as Ps, trapping into the surface state and thermal desorption from this state, as well as reflection back into the bulk. With this model vacancy formation enthalpies, activation energies of positrons from surface states, and specific trapping rates are deduced from the positronium fraction data. An amorphous Al/sub x/O/sub y/ overlayer on Al is discussed as an example of trapping in overlayers. In well-annealed single crystal samples the positron is shown to be freely diffusing at low temperatures, whereas in a neutron-irradiated Al single crystal sample the positron is localized at low positron binding energy defects presumably created during irradiation.

33954 **(CONF-800859—8) One and a half centered expansion for ion-atom collisions.** Reading, J.F.; Ford, A.L.; Becker, R.L. (Oak Ridge National Lab., TN (USA); Texas A and M Univ., College Station (USA). Dept. of Physics). 1980. Contract W-7405-ENG-26. 21p. NTIS, PC A02/MF A01. Order Number DE81028142.

From International conference on x-ray processes and inner-shell ionization; Stirling, UK (25 Aug 1980).

Fast ion-atom collisions in which charge transfer plays a dominant role have been traditionally treated by a two center expansion (TCE): the state wavefunction is approximated by a truncated set of Hilbert states centered on the target and projectile. This method is accurate but expensive in the use of computer time. A new method which allows charge transfer through variational time independent amplitudes, and target excitation and ionization through variational time dependent amplitudes is presented. The method retains the efficiency of a single centered expansion and yet reproduces the conventional TCE results in situations where charge transfer is dominant. Comparison to experiment is made.

33955 **(CONF-810868—1) Radiative lifetime of the 6p $^4P^0$/sub 5/2/ level in Xe II.** Pegg, D.J.; Gaillard, M.L.; Bingham, C.R.; Carter, H.K.; Mlekodaj, R.L. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA); UNISOR, Oak Ridge, TN (USA); Oak Ridge Associated Universities, Inc., TN (USA)). 1981. Contract W-7405-ENG-26. 16p. NTIS, PC A02/MF A01. Order Number DE81026542.

From 6. international conference on fast ion beam spectroscopy; Quebec, Canada (17 Aug 1981).

A new collinear laser-ion beam technique was used to measure the radiative lifetime of the 6p $^4P^0$/sub 5/2/ level in Xe II. The result of 7.95 +- 0.16 ns. is in disagreement with previous results. The apparatus was tested by making a similar measurement on the 6p $^2P$/sub 1/2/ level in Ba II whose lifetime is well established. Good agreement was found with the accepted value in this case.

33956 **(DOE/ER/03158—93) Direct experimental determination of the particle reflection coefficients of low-energy (100 to 1500 eV) $^3$He and $^4$He atoms from the (110) plane of tungsten.** Amano, J.; Seidman, D.N. (Cornell Univ., Ithaca, NY (USA). Materials Science Center). Mar 1981. Contract AS02-76ER03158. 16p. NTIS, PC A02/MF A01. Order Number DE81030047.

The particle reflection coefficients (R/sub N/) for low-energy (100 to 1500 eV) implanted $^3$He and $^4$He atoms were determined employing the atom-probe field-ion microscope (FIM) technique. The implantations were made in situ at 60 K with the ion beam parallel to the [110] direction, within +- $5^0$, of tungsten; the atom-probe FIM analyses were also performed at 60 K. At this temperature both the $^3$He and $^4$He atoms, as shown in our earlier work, are completely immobile. After an implantation, to a given fluence, the value of the particle retention coefficient (T/sub N/) was determined directly from the total measured number of helium atoms retained in the range profile that was parallel to the [110] direction. Then the value of R/sub N/ was calculated from the relationship R/sub N/ = 1 - T/sub N/. The experimental value of R/sub N/ decreases from ~ 0.85 to ~ 0.25, as the energy of the incident helium ion beam increases from 100 to 1500 eV. The results are compared with values of R/sub N/ calculated employing Biersack's and Haggmark's TRIM program; the calculated values are in fair agreement with the experimental data between 300 and 1500 eV.

33957 **(LA-UR—81-2473) Low temperature diffusion of positive muons in copper.** Clawson, C.W.; Crowe, K.M.; Kohn, S.E. Rosenblum, S.S.; Huang, C.Y.; Smith, J.L.; Brewer, J.H. (Lawrence Berkeley Lab., CA (USA); Los Alamos National Lab., NM (USA); British Columbia Univ., Vancouver (Canada). TRIUMF Facility). 1981. Contract W-7405-ENG-36. 10p. (CONF-810809—17). NTIS, PC A02/MF A01. Order Number DE81030255.

From 16. international conference on low temperature physics; Los Angeles, CA, USA (19 Aug 1981).

Measurement of the depolarization of positive muons in copper in zero external field shows that the hopping rate of the muons increases as the temperature decreases from 4.2 K to ~ 1K. This is the first unambiguous demonstration of muon diffusion behavior which is not thermally activated.

33958 **Diode laser spectroscopy of the transient $UF_5$ radical following laser photolysis of $UF_6$.** Kim, K.C.; Reisfeld, M.J. (Los Alamos Scientific Lab., NM (USA)); Person, W.B. (Florida Univ., Gainesville (USA). Dept. of Chemistry). *Journal of Molecular Structure ;* **60**: 205-213(Jan 1980).

From 14. European congress on molecular spectroscopy: Modern trends in spectroscopy (EUCMOS); Frankfurt am Main, Germany, F.R. (3 - 7 Sep 1979).

Laser photolysis of low pressure samples of gaseous $UF_6$ in a long path cell produces transient $UF_5$ radicals. Absorption by these radicals in the 16 $\mu$m-17$\mu\mu$m region of the infrared spectrum has been observed with an infrared diode laser monitor. The observed lifetime of the absorbing species is long (approx. 500 $\mu$s) and suggests an additional channel for the production of $UF_5$ at low pressures. Absorption by excited $UF_6$ molecules formed by recombination of F atoms and $UF_5$ radicals has also been recorded.

33959 **(SAND—81-1337) Bremsstrahlung energy spectra from electrons of kinetic energy 1 keV $\leqq$ T $\leqq$ 2000 keV incident on neutral atoms 1 $\leqq$ Z $\leqq$ 92.** Kissel, L.; MacCallum, C.; Pratt, R.H. (Sandia National Labs., Albuquerque, NM (USA); Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy). Aug 1981. Contract AC04-76DP00789. 73p. NTIS, PC A04/MF A01. Order Number DE81030984.

A tabulation is presented of theoretical predictions for the electron bremsstrahlung energy spectrum from neutral atoms as a function of atomic number Z, incident electron kinetic energy T, and fraction of energy radiated k/T (k is the emitted photon energy). Tabulated values for 2 $\leqq$ Z $\leqq$ 92 are obtained by interpolation from a smaller set of calculated data points. These calculated points were obtained by describing bremsstrahlung as a single-electron transition in a relativistic self-consistent screened potential. Tabulated values for Z = 1 are obtained from the formfactor corrected Born approximation times the Elwert Factor. The tables correct errors found in a previous tabulation. Various plots of the tabulation are presented and the general behavior of the energy spectrum is discussed. Energy scaling of the spectrum is investigated and T/Z is found to best scale the data.

33960 **Gas-phase reactions of $Fe^+$ with ketones and ethers.** Burnier, R.C.; Byrd, G.D.; Freiser, B.S. (Purdue Univ., West Lafayette, IN). *Journal of the American Chemical Society ;* **103**: No. 15, 4360-4367(29 Jul 1981).

A pulsed laser has been used in conjunction with an ion cyclotron resonance spectrometer to generate and study the gas-phase ion-molecule reactions of $Fe^+$ with simple carbonyl compounds and ethers. Oxidative addition reactions are observed, producing alkyl acyl, and alkoxide intermediates which undergo intramolecular rearrangement by a $\beta$-hydride shift mechanism. Decarbonylation reactions are observed with only a few small ketones. The main reaction channel is dehydrogenation for unbranched ketones and reductive elimination of methane for those branched at the $\alpha$ carbon. Reactions of $Fe^+$ with diisopropyl ketone, cyclohexanone, cyclopentanone, and tetrahydrofuran suggest the existence of intermediate and stable $\pi$-ally complexes resulting from sequential $\beta$-hydride shifts.

33961 **Photodetachment cross sections for $He^-$ ($^4P^0$).** Compton, R.N.; Alton, G.D.; Pegg, D.J. (Oak Ridge National Lab., TN (USA)). *Journal of Physics B: Atomic and Molecular Physics ;* **13**: No. 22, L651-L655(28 Nov 1980).

The first measurements of photodetachment cross sections for $He^-$ (formed through charge exchange of $He^+$ with Ca vapour) over the photon energy range from 1.77 to 2.75 eV are reported. Uncertainties with the electronic configuration of the $He^-$ ion are removed by determining the energy of the autodetached electrons. The measured autodetached electron energy agrees with the known $(1s2s2p)^4P^0$ $He^-$ energy level.

## 6404 Fluid Physics

*REFER ALSO TO CITATION(S) 33653*

**33962 (LALP—81-29) Bibliography Group T-3, 1955-1980.** Salazar, J.; Romero, J. (comp.). (Los Alamos National Lab., NM (USA)). Jul 1981. Contract W-7405-ENG-36. 27p. NTIS, PC A03/MF A01. Order Number DE81030500.

This bibliography includes all known unclassified publications by members of Group T-3 since 1955. They principally describe or show the extensive use of numerical computing methods for hydrodynamics problems developed by members of Group T-3. The subject areas include high-speed fluid dynamics, incompressible hydrodynamics, fluid dynamics at all flow speeds, molecular physics, plasma physics, turbulence, reactive flows, and miscellaneous fluid and solid dynamics. (GHT)

**33963 (PNL-SA—9712) Study of non-Darcy natural convection from a vertical heated surface in a saturated porous medium.** Huenefeld, J.C.; Plumb, O.A. (American Society of Mechanical Engineers, New York). 1981. Contract AC06-76RL01830. 8p. (CONF-810804—17). NTIS, PC A02/MF A01. Order Number DE81030081.

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

The buoyancy-induced boundary layer adjacent to a vertical, uniformly heated foil imbedded in a saturated porous medium was investigated experimentally. Temperature profiles were measured for Rayleigh numbers ranging from 136 to 4640 corresponding to Reynolds numbers based on the particle diameter of from 0.85 to 10.5. For Reynolds numbers in excess of 3, the temperature profiles exhibit spatial and temporal fluctuations. Experimental results for the heat transfer obtained within a porous matric composed of glass beads 5 mm in diameter resulted in the correlation Nu/sub x/ = 0.527 (Ra/sub x/)$^{0.576}$ as compared to Nu/sub x/ = 0.678 (Ra/sub x/)$^{0.500}$ from the analytical Darcy flow result. This discrepancy is in part attributed to non-Darcy effects. The effect of the permeability increase at the wall/porous medium interface is qualitatively examined for different size particles. The results indicate that the wall effect is a strong function of particle diameter.

**33964 (SAND—81-1135C) Dynamic shear-wave velocity measurements using interferometric techniques.** Chhabildas, L.C. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 14p. (CONF-810939—1). NTIS, PC A02/MF A01. Order Number DE81026973.

From International congress on instrumentation in aerospace simulation facilities; Dayton, OH, USA (30 Sep 1981).

An optical technique is described which uses velocity interferometers, VISARS, to determine the particle velocity changes associated with plane shear wave propagation. In this technique, two velocity interferometers are used to monitor different diffracted laser beams from a surface which undergoes both longitudinal and shear motion. Fringes produced in the interferometer are proportional to a linear combination of both the longitudinal and shear components of the free surface velocity. By obtaining two different recordings of the motion, the two components can be separated. A few selected examples of shear wave interferometry applications are reported in this paper.

## 6451 Particle Interactions And Properties - Experimental

*REFER ALSO TO CITATION(S) 34012*

**33965 (BNL—30026) Search for the violation of time-reversal invariance in K/sub $\mu$3/ decays.** Morse, W.M.; Leipuner, L.B.; Larsen, R.C.; Blatt, S.R.; Campbell, M.K.; Adair, R.K.; Black, J.K.; Kasha, H.; Schmidt, M.P. (Brookhaven National Lab., Upton, NY (USA); Yale Univ., New Haven, CT (USA)). Aug 1981. Contract AC02-76CH00016. 5p. (CONF-810760—1). NTIS, PC A02/MF A01. Order Number DE81030557.

From International conference on high energy physics; Lisbon, Portugal (9 Jul 1981).

The polarization of the $\mu^+$ from the decays K$^0$/sub L/ $\rightarrow \pi^- \mu^+ \nu$ and $K^+ \rightarrow \pi^0 \mu^+ \nu$ was measured. The transverse polarization forbidden by time reversal invariance is (1.85 +- 3.60) x $10^{-3}$ based on the final data sample of thirty-four million events. This null result places constraints on certain models of CP-violation through the exchange of Higgs bosons.

**33966 (DOE/ER/03509—T1) Progress report, October 1, 1980-June 30, 1981.** (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1981. Contract AS05-76ER03509. 43p. NTIS, PC A03/MF A01. Order Number DE81028656.

Research is summarized in experimental and theoretical high energy physics. The experimental program includes searches for Xi, baryonium, hyperonium and glueballs. The particle theory projects include heavy particle photoproduction, fourth-order calculation of the longitudinal structure function in deep inelastic scattering, deep inelastic phenomenology, a conference on perturbative QCD, Cornell $Z^0$ workshop, the XII international symposiums on multiparticle dynamics, and the Valon-Parton recombination model. (GHT)

**33967 (DOE/ER/04195—5) Experimental study of the sigma-nucleon system through the reaction d(K,$\pi$)SIGMA N. Progress report, January 1, 1981-December 31, 1981.** Stearns, R.L. (Vassar Coll., Poughkeepsie, NY (USA)). Aug 1981. Contract AS02-77ER04195. 25p. (COO—4195-5). NTIS, PC A02/MF A01. Order Number DE81030026.

During the first half of 1981, considerable time and effort was devoted to the analysis and interpretation of observed hypernuclear levels in $\Lambda^{13}$C, $\Lambda^{14}$N and $\Lambda^{18}$O by the Brookhaven collaboration which included people from the University of Houston, Carnegie-Mellon University and M.I.T. These data were obtained using the ($K^-,\pi^-$) reaction and incident Kaons of momentum 800 MeV/c. The experimental arrangement, including the Brookhaven hypernuclear spectrometer, has been described in an earlier publication. These measurements, the first ever made on these nuclei, were taken at scattering angles ranging from 0$^0$ to 25$^0$ corresponding to momentum transfers from 50 to 330 MeV/c. The levels are interpreted in terms of a $\Lambda$ hyperon coupled to a strangeness zero nuclear core, the results providing insights into the properties of the $\Lambda$-nucleon and $\Lambda$-nucleus interactions.

**33968 (DOE/ER/04660—1) Very-high-energy nuclear physics. Progress report, July 1, 1980-June 30, 1981.** Frankel, S. (Pennsylvania Univ., Philadelphia (USA)). 14 Jul 1981. Contract AS02-78ER04660. 9p. NTIS, PC A02/MF A01. Order Number DE81030025.

This report covers recent completed work, work in progress, and plans for the future developed during the period July 1, 1980 to July 1, 1981. It describes two main activities, those in connection with experiments carried out at LAMPF and devoted to studies of high momentum phenomena in nuclei and those carried out at CERN devoted to ultrarelativistic nuclear-nuclear collisions.

**33969 (LBL—12950) What can we learn from inclusive spectra.** Nagamiya, S. (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 65p. (CONF-8105104—4). NTIS, PC A04/MF A01. Order Number DE81028129.

From 5. high energy heavy ion study; Berkeley, CA, USA (18 May 1981).

The present experimental status on single particle inclusive measurements is described. Then, the geometrical aspect of the collision is discussed from the data of total integrated cross sections of nuclear charge or mass. The dynamical aspect of the collision, especially that for the participating region is discussed in connection with proton spectra, composite fragment spectra, pion production, ratios of $\pi^-/\pi^+$, n/p and t/$^3$He, and production of strange particles. The spectator physics is described from the data on projectile fragments. (GHT)

**33970 (SLAC-PUB—2761) Quarkonium spectroscopy.** Scharre, D.L. (Stanford Linear Accelerator Center, CA (USA)). Jun 1981. Contract AC03-76SF00515. 86p. (CONF-8105109—1). NTIS, PC A05/MF A01. Order Number DE81028229.

From International conference on physics in collision: High energy ee/ep/pp interactions; Blacksburg, VA, USA (28 May 1981).

Recent experimental investigations of heavy quark-antiquark bound state systems are reviewed. Results from SPEAR on char-

monium spectroscopy and from DORIS and CESR on bottomonium spectroscopy are presented. The current status of the search for top is also discussed.

33971 **Finite particle number effects in high-energy nuclear collisions. Implications on pion spectra.** Bohrmann, S.; Knoll, J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Physics* [*Section*] *A ;* **356**: No. 2, 498-516(23 Mar 1981).

We study pion production from high-energy nuclear collisions by means of a simple statistical model. The shapes of the observed spectra exclude all pions that result from freely decaying delta resonances. Rather, they have to participate in kinetic equilibration processes. Finite particle number effects are found to be very important: equilibration does not occur globally but rather in groups of only a few particles. The pion production rates cannot be explained in terms of a chemical equilibrium.

33972 **Inclusive $\pi 0$ and eta production from kaon, proton and antiproton beams in the triple-Regge region.** Kennett, R.G.; Barnes, A.V.; Fox, G.C.; Walker, R.L. (California Inst. of Tech., Pasadena (USA)); Dahl, O.I.; Kenney, R.W.; Ogawa, A.; Pripstein, M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Physics* [*Section*] *B ;* **177**: No. 1, 1-20(5 Jan 1981).

Data are presented on the reactions Ksup(+-)p $\rightarrow \pi^0$X, Ksup(+-)p $\rightarrow$ etaX, pp $\rightarrow \pi^0$X and anti pp $\rightarrow \pi^0$X in the kinematic region with s approx. equal to 200 GeV$^2$, x approx. $> 0.7$ and -t approx. $< 1$ GeV$^2$. The data agree well with the predictions of triple-Regge theory, and the Ksup(•) and nucleon Regge trajectories extracted from the data agree with the linear trajectories extrapolated from the particle poles.

33973 **Study of the reaction $\nu n \rightarrow \nu p \pi^-$.** Derrick, M.; Fernandez, E.; Hyman, L.; Levman, G.; Koetke, D.; Musgrave, B.; Schreiner, P.; Singer, R.; Toaff, S. (Argonne National Lab., IL (USA)); Barish, S.J. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). *Physics Letters,* [*Section*] *B ;* **92**: No. 3/4, 363-366(May 1980).

We have measured the excitation function for the neutral current process $\nu n \rightarrow \nu p \pi^-$ as a function of neutrino energy. Our data give a cross section ratio R = sigma($\nu p \pi^-$)/sigma($\mu^- p \pi^+$) = 0.11 +- 0.022 over the energy interval (0.3 <= Esub($\nu$) <= 1.5) GeV. This measurement of single-pion production in a kinematically defined reaction is the first to use a deuterium target. The R value, as well as other characteristics of the data, agrees with the Adler model for single-pion production via the neutral current and gives a value of sin$^2$THETAsub(w) = 0.26 +- 0.09.

## 6452 Particle Interactions And Properties - Theoretical

33974 **(LBL—12972) Non-linear vacuum polarization in strong fields.** Gyulassy, M. (Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 17p. (CONF-8106148—1). NTIS, PC A02/MF A01. Order Number DE81028039.

From North Atlantic Treaty Organization-advanced summer institute summer school on QED of strong fields; Lahnstein, F.R. Germany (14 Jul 1981).

The Wichmann-Kroll formalism for calculating the vacuum polarization density to first order in $\alpha$ but to all orders in $Z\alpha$ is derived. The most essential quantity is shown to be the electrons Green's function in these calculations. The method of constructing that Green's function in the field of finite radius nuclei is then presented.

33975 **Soft-gluon effects in nonleptonic decays of charmed mesons.** Shizuya, K. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Physics Letters,* [*Section*] *B ;* **100**: No. 1, 79-83(19 Mar 1981).

Soft-gluon effects in nonleptonic decays of D and F mesons are studied nonperturbatively by use of a QCD multipole expansion. For reasonable values of D-meson bound-state parameters, the soft-gluon effects lead to a significant difference in the lifetimes of the $D^0$ and $D^+$ mesons.

33976 **Non-leptonic weak decay rate of explicitly flavored heavy mesons.** Suzuki, M. (California Univ., Berkeley (USA). Dept. of Physics; California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Physics* [*Section*] *B ;* **177**: No. 3, 413-426(19 Jan 1981).

It is argued quantitatively that a large difference between the $D^0$ and $D^+$ lifetimes is mainly due to non-perturbative long-distance effects. The total non-leptonic weak decay rates are related to the soft limit of short-distance processes. Scaling laws for the decay rates of heavy mesons with respect to mass are inferred from the QCD analysis of the soft limit of fragmentation. It is found that the decay rates are not determined by the disconnected spectator diagrams alone even in the limit of the heavy quark mass M Going to infinity (< Msub(W)), since the leading term after the QCD correction scales like M$^a$ exp $\sqrt{}$ c log M. Some numerical discussion is made for the decay of B mesons and T mesons.

33977 **Neutrino masses: theory and experiment.** Marciano, W.J. (Rockefeller Univ., New York (USA); Brookhaven National Lab., Upton, NY (USA)). *Comments on Nuclear and Particle Physics ;* **9**: No. 5, 169-184(Jan 1981).

Assuming the premise that neutrinos do have mass, the following questions are discussed in this Comment; How can neutrinos be given mass in the Weinberg-Salam model, are there bounds on the number of neutrino species, what are the cosmological implications of massive neutrinos, could they supply the missing mass to close the universe, what are neutrino oscillations and how might they be observed, can neutrino oscillations provide a solution to the solar neutrino problem, and what other new phenomena might a neutrino mass imply.

33978 **Heavy quarks in electroproduction.** Abbott, L.F. (Brandeis Univ., Waltham, MA (USA). Dept. of Physics); Wise, M.B. (Stanford Linear Accelerator Center, CA (USA)). *Nuclear Physics* [*Section*] *B ;* **176**: No. 2, 373-396(22 Dec 1980).

The idea of an effective light-particle field theory is used to analyze the effects of heavy quarks in electroproduction. The b-quark distribution is predicted at large $Q^2$ and a systematic treatment of the changing number of quark flavors in a QCD analysis of $F_2$ is presented.

33979 **Bounds on the masses of neutral generation-changing gauge bosons.** Cahn, R.N. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); Harari, H. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). *Nuclear Physics* [*Section*] *B ;* **176**: No. 1, 135-152(8 Dec 1980).

The existence of several generations of quarks and leptons suggests the possibility of a gauge symmetry connecting the different generations. The neutral gauge bosons of such a scheme would mediate rare processes such as Ksup(O)sub(L) $\rightarrow$ $\mu$sup(+-)sup(e)sup(+-), $K^+ \rightarrow \pi^+ e^- \mu^+$, $\mu N \rightarrow eN$ and would contribute to $\Delta$M(Ksup(O)sub(S)-Ksup(O)sub(L)). We study these and other processes within a simple theoretical framework and derive bounds involving the masses and coupling constants of the generation-changing gauge bosons and various generation-mixing angles. The lower bounds for the relevant masses lie in the 10-100 TeV region. Various remarks concerning the relevance of these bounds to currently popular theoretical ideas and to future experiments are presented.

33980 **Two-photon contributions to lepton production in pp scattering.** Carlson, C.E. (College of William and Mary, Williamsburg, VA (USA). Dept. of Physics); Lassila, K.E. (Ames Lab., IA (USA); Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Physics). *Physics Letters,* [*Section*] *B ;* **97**: No. 2, 291-293(1 Dec 1980).

We find that the two-photon process in proton-proton scattering is a significant or dominant contribution to certain channels at sufficiently high energy. In particular, for colliding 1 TeV protons on 1 TeV protons the production of $e^+e^-$ pairs via two photons is larger than the production from the Drell-Yan process for pair masses up to approx. 60 GeV.

**33981 Unification of elementary forces.** Gaillard, M.K. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Comments on Nuclear and Particle Physics ;* **9**: No. 2, 39-47(1980).

The quantum field theory known as the unified theory of weak and electromagnetic interactions and the concomitant development of a theory of strong interactions as also derivable from the coupling of massless vector bosons to conserved matter currents are discussed in the context of single unified interaction. The basic concept that all particle interactions derive from a simple Lagrangian with massless fermions (matter fields) and vector mesons whose couplings to one another and to the fermions are governed by a single coupling constant analogous to the electric charge is examined. It is shown that the three independent coupling constants of elementary forces are consistent with a common 'bare' value and that at least some quark and lepton masses appear to be related. Mechanisms for understanding the observed baryon asymmetry of the universe, the apparent mass lessness of neutral leptons and the fractional charge of quarks are possible.

## 6453 Particle Invariance Principles And Symmetries

*REFER ALSO TO CITATION(S) 33934*

**33982 Topological theory of electric charge.** Chew, G.F. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; California Univ., Berkeley (USA). Dept. of Physics); Finkelstein, J. (San Jose State Univ., CA (USA). Dept. of Physics); McMurry, R.E. Jr. (California Univ., Berkeley (USA). Dept. of Physics); Poenaru, V. (Paris-11 Univ., 91 - Orsay (France). Dept. de Mathematiques). *Physics Letters, [Section] B ;* **100**: No. 1, 53-56(19 Mar 1981).

A recently-proposed topological theory of strong interactions is extended to electromagnetism. The values of the electric charges of both hadrons and leptons emerge naturally.

**33983 (LA-UR—81-2635) Future LAMPF experiments on lepton-number nonconservation.** Mischke, R.E. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 11p. (CONF-8106156—2). NTIS, PC A02/MF A01. Order Number DE81030234.

From International conference on neutrino physics and astrophysics; Maui, HI, USA (30 Jun 1981).

Planned experiments at LAMPF involving neutrinoless processes which are sensitive to lepton-number nonconservation are discussed with emphasis on the Crystal Box program.

**33984 Large distance effects in CP violation and the $K^0$-anti $K^0$ mass matrix.** Hill, C.T. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Physics Letters, [Section] B ;* **97**: No. 2, 275-278(1 Dec 1980).

Large distance contributions to the $K^0$-$K^0$ mass matrix are often neglected but have important consequences for CP violation. If penguins dominate $/\Delta S/ = 1$ weak decays then these large distance contributions correspond to (penguin)$^2$ diagrams and receive potentially large CP-violating phases. We argue that this effect reduces the size of /epsilon'/epsilon/ by approx. 1/2.5 in the KM model. In the extreme penguin limit, f = 1 and epsilonsub(m) = 0, we have /epsilon'/epsilon/ approx. 1/50.

## 6454 Field Theory

*REFER ALSO TO CITATION(S) 33934*

**33985 (BNL—29768) QCD, OZI, and evidence for glueballs.** Lindenbaum, S.J. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 21p. (CONF-810376—5). NTIS, PC A02/MF A01. Order Number DE81025808.

From 16. rencontre de moriond: nonperturbative QCD: theory and experiment; Les Arcs, France (15 Mar 1981).

The characteristics expected from low Q-QCD for the behavior of glueballs and the OZI rule is discussed. The reaction $\pi^-$ p → phi phi n represents on OZI forbidden (hairpin) diagram. It has been observed at the Brookhaven National Laboratory multiparticle spectrometer by the Brookhaven National Laboratory/City College of New York group. The author has shown that the expected OZI suppression is essentially entirely absent and in fact the Isobar Model which does not contain OZI suppression quantitatively explains the observed results. A general evaluation of the special characteristics of the data compared to other related reactions plus the foregoing facts leads the author to conclude that the intervention of glueball resonances is the likely explanation in the context of QCD. Other explanations are shown to be improbable. In particular the hypothesis that decay of a radial excitation of the eta' is responsible for lack of OZI suppression is ruled out. Planned experiments with the purpose of explicity discovering glueballs will be discussed. The OZI rule peculiarities such as violation of crossing symmetry and unitarity are attributed to color confinement.

**33986 (BNL—29823) Phase transitions and variant actions in lattice gauge theory.** Creutz, M. (Brookhaven National Lab., Upton, NY (USA)). Jun 1981. Contract AC02-76CH00016. 12p. (CONF-8106146—1). NTIS, PC A02/MF A01. Order Number DE81029324.

From Workshop on nonperturbative studies in quantum chromodynamics; Providence, RI, USA (19 Jun 1981).

Unexpected phase structure in four dimensional lattice gauge theory based on the groups SO(3) and SU(5) have prompted studies of variations on the Wilson action for SU(2). A rich phase structure related to the decomposition of SU(2) into SO(3) and $Z_2$ is found. The scale of asymptotic freedom has a dramatic dependence on the choice of lattice action.

**33987 (BNL—29840) Numerical studies of gauge field theories.** Creutz, M. (Brookhaven National Lab., Upton, NY (USA)). Jun 1981. Contract AC02-76CH00016. 28p. (CONF-810762—1). NTIS, PC A03/MF A01. Order Number DE81030526.

From 19. international school of subnuclear physics; Erice, Italy (31 Jul 1981).

Monte Carlo simulation of statistical systems is a well established technique of the condensed matter physicist. In the last few years, particle theorists have rediscovered this method and are having a marvelous time applying it to quantized gauge field theories. The main result has been strong numerical evidence that the standard SU(3) non-Abelian gauge theory of the strong interaction is capable of simultaneously confining quarks into the physical hadrons and exhibiting asymptotic freedom, the phenomenon of quark interactions being small at short distances. In four dimensions, confinement is a non-perturbative phenomenon. Essentially all models of confinement tie widely separated quarks together with strings of gauge field flux. This gives rise to a linear potential at long distances. A Monte Carlo program generates a sequence of field configuration by a series of random changes of the fields. The algorithm is so constructed that ultimately the probability density for finding any given configuration is proportional to the Boltzmann weighting. We bring our lattices into thermal equilibrium with a heat bath at a temperature specified by the coupling constant. Thus we do computer experiments with four-dimensional crystals stored in a computer memory. As the entire field configuration is stored, we have access to any correlation function desired. These lectures describe the kinds of experiments being done and the implications of these results for strong interaction physics.

**33988 (DOE/ER/03023—T1) Radiation reaction force and unification of electromagnetic and gravitational fields.** Lo, C.Y.; Goldstein, G.R.; Napier, A. (Tufts Univ., Medford, MA (USA). Dept. of Physics). Apr 1981. Contract AC02-76ER03023. 26p. NTIS, PC A03/MF A01. Order Number DE81029086.

A unified theory of electromagnetic and gravitational fields should modify classical electrodynamics such that the radiation reaction force is accounted for. The analysis leads to a five-dimensional unified theory of five variables. The theory is supported by showing that, for the case of a charged particle moving in a constant magnetic field, the radiation reaction force is indeed included. Moreover, this example shows explicitly that physical changes are associated with the fifth variable. Thus, the notion of a physical five-dimensional space should be seriously taken into consideration.

33989 **(SLAC-PUB—2776) Fundamental tests and measures of the structure of matter at short distances.** Brodsky, S.J. (Stanford Linear Accelerator Center, CA (USA)). Jul 1981. Contract AC03-76SF00515. 38p. NTIS, PC A03/MF A01. Order Number DE81030644.

Recent progress in gauge field theories has led to a new perspective on the structure of matter and basic interactions at short distances. It is clear that at very high energies quantum electrodynamics, together with the weak and strong interactions, are part of a unified theory with new fundamental constants, new symmetries, and new conservation laws. A non-technical introduction to these topics is given, with emphasis on fundamental tests and measurements. 21 references.

33990 **Why masses and magnetic moments satisfy naive quark model predictions.** Cohen, I. (Weizmann Inst. of Science, Rehovoth (Israel)); Lipkin, H.J. (Fermi National Accelerator Lab., Batavia, IL (USA); Argonne National Lab., IL (USA)). *Physics Letters, [Section] B ;* **93**: No. 1/2, 56-60(Jun 1980).

Relativistic and zero point energy corrections are shown to be absorbed in renormalizing phenomenological quark mass parameters appearing in quark model descriptions of baryon and meson masses and baryon and magnetic moments and do not affect successful relations. Analysis of small differences between effective quark masses in mesons and baryons gives two new successful relations between meson and baryon masses.

# 65 PHYSICS RESEARCH

## 6510 Nuclear Physics

33991 **(DOE/ER/02696—11) Neutron cross section measurements using the ORELA: the stable tellurium isotopes (n,γ), $^{238}$U(n,n'), $^{232}$Th(n,n'), $^{187}$Os(n,n'), $^{186\ 187\ 188}$Os(n,nn'γ), and $^{205}$Tl(n,nγ). Progress report, September 1, 1980-September 1, 1981.** Winters, R.R. (Denison Univ., Granville, OH (USA)). Aug 1981. Contract AS02-76ER02696. 7p. NTIS, PC A02/MF A01. Order Number DE81030164.

Progress on the following subjects is reviewed: (1) high resolution neutron cross sections and the optical model potential, (2) renormalization of neutron capture cross sections, and (3) measurement of the argon 40 total cross section. (WHK)

33992 **(DOE/ER/04215—5) Nuclear structure study at intermediate energies. Annual progress report, November 1980-July 1981.** Hintz, N.M. (Minnesota Univ., Minneapolis (USA)). 1981. Contract AS02-77ER04215. 128p. NTIS, PC A07/MF A01. Order Number DE81030156.

Research from November 1980 through August 1981 by the University of Minnesota group is summarized. Research experiments included HRS development (high resolution spectrometer at LAMPF; proton scattering on 2s - 1d shell nuclei at 800 MeV; proton scattering from heavy deformed nuclei at 800 MeV; proton scattering from heavy deformed nuclei; measurement of spin-flip probabilities in inelastic scattering; inelastic scattering at 333 and 500 MeV; and computer program development and theoretical analysis. (GHT)

33993 **(DOE/ER/10472—1) Summary of the proceedings of the workshop on future directions in nuclear physics research.** (Colorado Univ., Boulder (USA)). 1979. Contract AC02-79ER10472. 86p. (CONF-7905110—(Summ)). NTIS, PC A05/MF A01. Order Number DE81025937.

From Workshop on the future directions of nuclear physics; Boulder, CO, USA (29 May 1979).

The workshop was intended to gather active researchers in nuclear physics to discuss the directions for research during the next 10 to 15 years. Topics discussed included: fundamental interactions; nuclear spectroscopy; electromagnetic nuclear physics; intermediate energy physics; heavy ion physics; and interrelationships among subfields of nuclear physics.

33994 **(DOE/ER/70035—4) Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981.** Loveland, W.D. (Oregon State Univ., Corvallis (USA)). Jul 1981. Contract AM06-76RL02227. 134p. NTIS, PC A07/MF A01. Order Number DE81030323.

This is a report of progress on the study of low-energy, intermediate-energy, and relativistic heavy-ion reactions. Data in particular are presented for: $^{44}$Sc isomer ratio in $^{29}$Si($^{18}$O,p2n) reaction; fragment angular distributions in reaction of 86 MeV/μ $^{12}$C with $^{197}$Au and $^{238}$U; fragment recoil properties in reaction of 50 to 86 MeV/μ $^{12}$C with $^{181}$Ta and $^{197}$Au; target fragmentation in heavy ion reactions with Au; fragment yields and mass distributions in reactions of $^{20}$Ne, $^{12}$C, and protons with $^{181}$Ta and $^{238}$U; fragment angular momenta of precursor of $^{44}$Sc produced in reaction of 25-GeV $^{12}$C and 80-GeV $^{40}$Ar with Cu; fragmentation of $^{165}$Ho by $^{12}$C and protons at various energies; and energy dependence of the total cross section of $^{20}$Ne + $^{181}$Ta reaction. Reprints and preprints are included in the appendix. (DLC)

33995 **(LA-UR—81-2410) Intermediate energy proton and light-ion scattering.** Moss, J.M. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 13p. (CONF-810747—4). NTIS, PC A02/MF A01. Order Number DE81030115.

From 9. international conference on high energy physics and nuclear structure; Versailles, France (6 Jul 1981).

A review is presented of recent (1979-81) developments in the field of intermediate-energy proton and light-ion scattering from nuclei. New theoretical and calculational techniques of particular interest to experimentalists are discussed. Emphasis is placed on topics in nuclear structure physics - giant resonances, pion-condensation precursor phenomena, and polarization transfer (spin-flip) experiments - where intermediate energy proton and light-ion scattering has made new and unique contributions.

33996 **New surface phenomena in heavy-ion-induced reactions.** Barrette, J.; Kahana, S. (Brookhaven National Lab., Upton, NY (USA)). *Comments on Nuclear and Particle Physics ;* **9**: No. 3, 67-78(1980).

Recent studies of elastic and inelastic scattering at far backward angles for mass-asymmetric heavy-ion systems and of related excitation functions in transfer reactions are considered. The data obtained have uncovered some deficiencies in the present optical description of the ion-ion potential and consequently are likely to provide a more refined understanding of these interactions. New developments examined include (a) the observation of structure in the backward-hemisphere angular distributions for systems such as $^{13}$C + $^{28}$Si and $^{16}$O + $^{28}$Si, in particular a sharp rise in cross section at 180°; (b) the presence of broad, resonance-like structure (width 1-2MeV) in the elastic and inelastic excitation functions near 180°; (c) the observation of similar and probably related broad structure in the energy dependence of α-transfer reactions in the forward as well as backward hemispheres.

## 6511 Experimental Techniques

*REFER ALSO TO CITATION(S) 34009*

## 6512 Nuclear Properties And Reactions, A=1-5

33997 **(LA—8937-T) Inclusive proton spectra and total reaction cross sections for proton-nucleus scattering at 800 MeV.** McGill, J.A. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 103p. NTIS, PC A06/MF A01. Order Number DE81030505.

Thesis.

Current applications of multiple scattering theory to describe the elastic scattering of medium energy protons from nuclei have been shown to be quite successful in reproducing the experimental cross sections. These calculations use the impulse approximation, wherein the scattering from individual nucleons in the nucleus is described by the scattering amplitude for a free nucleon. Such an approximation restricts the inelastic channels to those initiated by nucleon-nucleon scattering. As a first step in determining the nature of p + nucleus scattering at 800 MeV, both total reaction cross

sections and (p,p') inclusive cross sections were measured and compared to the free p + p cross sections for hydrogen, deuterium, calcium 40, carbon 12, and lead 208. It is concluded that as much as 85% of all reactions in a nucleus proceed from interactions with a single nucleon in the nucleus, and that the impulse approximation is a good starting point for a microscopic description of p + nucleus interactions at 800 MeV.

33998 **Description of polarization analyzing powers for three-body breakup reactions.** Ohlsen, G.G.; Brown, R.E.; Correll, F.D.; Hardekopf, R.A. (Los Alamos Scientific Lab., NM (USA)). *Nuclear Instruments and Methods ;* **179**: No. 2, 283-294(15 Jan 1981).

We present a discussion of the geometrical aspects of the measurement of analyzing powers for nuclear reactions with three particles in the final state that are induced by polarized spin-1 or spin-1/2 particles. The present interest is focussed on the reactions D(p vector, pp)n and H(d vector, pp)n, for which a measurement program at 16 MeV deuteron energy is currently underway at the Los Alamos Scientific Laboratory (LASL).

33999 **Two-nucleon pion absorption in $^{3}$sup(,)$^{4}$He.** Kaellne, J.; Davis, J.; Minehart, R.C.; Whitney, R.R. (Virginia Univ., Charlottesville (USA)); Boudrie, R.L. (Los Alamos Scientific Lab., NM (USA)); McClelland, J. (California Univ., Los Angeles (USA)); Stetz, A.W. (Oregon State Univ., Corvallis (USA)). *Physics Letters, [Section] B ;* **97**: No. 2, 205-208(1 Dec 1980).

Results are presented for $\pi^{+}$ sup(N)sup(N) → Np yields in $^{3}$sup(,)$^{4}$He relative to πd → pp from (π,p) measurements at energies between 50 and 295 MeV and estimates are given for total cross sections. These yields are nearly proportional to the number of target NN pairs, which is not true for $^{6}$Li and heavier nuclei. This is believed to indicate that πNN → Np is sensitive to the NN short-range behavior which is deuteron-like for $^{3}$sup(,)$^{4}$He but not always so for NN pairs in other nuclei.

## 6513 Nuclear Properties And Reactions, A=6-19

*REFER ALSO TO CITATION(S) 33997, 34033*

34000 **(DOE/ER/02853—T1) Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981.** Peterson, G.A. (Massachusetts Univ., Amherst (USA)). Aug 1981. Contract AS02-76ER02853. 33p. NTIS, PC A03/MF A01. Order Number DE81030058.

Electron scattering experiments are in progress at the Bates Linear Accelerator in Middleton, Massachusetts. Both magnetic elastic and transverse inelastic scattering cross sections have been measured at 180° by the apparatus constructed and brought into operation in late 1977 by the University of Massachusetts. A liquid-nitrogen-cooled gas target is being used in a study of deuteron elastic magnetic scattering and electrodisintegration over a large energy range. A measurement of elastic magnetic and transverse inelastic scattering from $^{14}$N has been started. Measurements of the elastic magnetic scattering from $^{13}$C, $^{15}$N, $^{27}$Al, $^{29}$Si, and $^{31}$P have been completed. The data set on $^{15}$N inelastic scattering are now complete and analysis of the data is in progress. A study of M8 transitions in $^{54}$Fe and $^{60}$Ni is nearing completion. Several papers are being written on these subjects. A measurement of the transverse quasi-elastic scattering from $^{56}$Fe has been started. Planning for an experiment utilizing radioactive $^{14}$C is underway. Large-basis shell model calculations pertaining to the above nuclei and others have been made. Theoretical calculations of exchange currents, nuclear convection currents, and other nuclear phenomena are in progress. Finally, considerations are being given to the design of an integrated storage-ring-experimental system.

34001 **Comparison of pion and photon induced reactions on complex nuclei.** McKeown, R.D.; Schiffer, J.P.; Jackson, H.E.; Paul, M.; Sanders, S.J.; Specht, J.R.; Stephenson, E.J. (Argonne National Lab., IL (USA)); Redwine, R.P. (Massachusetts Inst. of Tech., Cambridge (USA)); Segel, R.E. (Northwestern Univ., Evanston, IL (USA)); Arends, J. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). *Nuclear Physics [Section] A ;* **358**: 411-412(13 Apr 1981).

From Symposium on perspectives in electro- and photo-nuclear physics; Saclay, France (29 Sep - 3 Oct 1980).

The proton spectra from pion and photon induced reactions on $^{12}$C are found to be very similar in shape, and angular distribution. It appears that these protons arise from a common reaction mechanism (Δ production) for the two projectiles. Proton yields with pions and with photons are in approximately the same ratio as the total inelastic pion yield to the total photopion yield.

34002 **Measurement of the $^{18}$O photonuclear cross sections as a test of a bremsstrahlung unfolding technique.** Pywell, R.E.; Thompson, M.N. (Melbourne Univ., Parkville (Australia). School of Physics); Berman, B.L. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Instruments and Methods ;* **178**: No. 1, 149-156(1 Dec 1980).

The $^{18}$O[(γ,n) + 2(γ,2n)] and $^{18}$O(γ,p) cross sections have been measured using the bremsstrahlung yield-curve technique. Unfolding of the yield curves to obtain the cross sections is carried out using the Variable-Bin-Penfold-Leiss technique. The results obtained agree very well with the results obtained using monoenergetic photons. The accuracy of the bremsstrahlung yield-curve technique and the resolution obtainable with this technique are thereby established.

34003 **Search for resonances in $^{12}$C($^{9}$Be,α)$^{17}$O.** Dennis, L.C.; Cordell, K.R.; Doering, R.R.; Parks, R.L.; Thornton, S.T. (Virginia Univ., Charlottesville (USA). Dept. of Physics); Ford, J.L.C. Jr.; Gomez del Campo, J.; Shapira, D. (Oak Ridge National Lab., TN (USA)). *Nuclear Physics [Section] A ;* **357**: No. 2, 521-532(6 Apr 1981).

Excitation functions at 7° (lab) have been measured from Esub(c)sub(.)sub(m)sub(.) = 5.1 to 11.4 MeV in approximately 114 keV steps for 15 groups of final states in $^{17}$O populated by the $^{12}$C($^{9}$Be,α) reaction. Statistical tests have been used to locate possible non-statistical structure in the excitation functions. Possible anomalies were found near Esub(c)sub(.)sub(m)sub(.) = 6.3, 7.5, 8.9 and 9.7 MeV. Angular distributions were measured at Esub(c)sub(.)sub(m)sub(.) = 9.20, 9.71 and 10.23 MeV for the three lowest excited states in $^{17}$O. The data have been compared with Hauser-Feshbach calculations in addition to the following reaction mechanisms: compound plus a single resonance, compound plus interfering resonances and compound plus direct reactions.

34004 **Corrections to the closure approximation for the pion-nucleon t-matrix inside the nucleus.** Garcilazo, H. (Texas A and M Univ., College Station (USA). Dept. of Physics); Gibbs, W.R. (Los Alamos Scientific Lab., NM (USA). Theoretical Div.). *Nuclear Physics [Section] A ;* **356**: No. 2, 284-306(23 Mar 1981).

We give a solution to the three-body model of the optical potential of Revai, and Tandy, Redish and Bolle, which is valid in the case when the projectile is very light. The resulting potential includes corrections to the projectile-nucleon t-matrix which arise because the target nucleon is in interaction with the rest of the nucleus. We study the pion-carbon optical potential at energies below the 3,3 resonance by calculating the elastic differential cross section and reaction cross sections to the inelastic channels. As shown in the work of Tandy, Redish and Bolle, the reactive content of the optical potential consists of two inelastic channels corresponding to nucleon knockout and nucleon pick-up. We use the pick-up channel as a model of pion absorption with one-nucleon emission, by treating the nucleon as a bound state of a pion and a nucleon.

**34005 Measurements of isospin mixing between the $1^+$ doublet in $^{12}C$ using pion inelastic scattering.** Morris, C.L.; Boudrie, R.L.; Piffaretti, J. (Los Alamos Scientific Lab., NM (USA)); Cottingame, W.B.; Braithwaite, W.J.; Greene, S.J.; Harvey, C.J.; Holtkamp, D.B.; Moore, C.F. (Univ. of Texas, Austin (USA)); Seestrom-Morris, S.J. (Minnesota Univ., Minneapolis (USA)). *Physics Letters, [Section] B ;* **99**: No. 5, 387-390(5 Mar 1981).

Pion inelastic scattering has been used to extract the off-diagonal charge dependent matrix element, $H_{01}$, between the Jsup($\pi$) = $1^+$ doublet of states at 12.71 (T = 0) and 15.11 (T = 1) MeV in $^{12}C$. The reported measurements yield a value, $H_{01}$ = 148 +- 29 keV, in good agreement with recent electromagnetic measurements.

**34006 Energy dependence of nucleus-nucleus total cross sections.** Peng, J.C.; De Vries, R.M.; Di Giacomo, N.J. (Los Alamos Scientific Lab., NM (USA). Physics Div.). *Physics Letters, [Section] B ;* **98**: No. 4, 244-247(15 Jan 1981).

The energy dependence of nucleus-nucleus total cross sections (sigmasup(N)sup(N)sub(T)) has been investigated for p, d, $^3$He, $\alpha$, and $^{12}$C on $^{12}$C. The sigmasub(T) data exhibit an even more pronounced drop at medium energies than seen in the nucleus-nucleus sigmasub(R) data. Microscopic calculations based on the optical limit of the Glauber theory provide a good description of the available sigmasub(T) data.

**34007 Gross structure and resonant behavior of $^{14}C$ + $^{14}C$ elastic scattering.** Drake, D.M.; Cates, M. (Los Alamos Scientific Lab., NM (USA)); Cindro, N.; Pocanic, D.; Holub, E. (Institut Rudjer Boskovic, Zagreb (Yugoslavia)). *Physics Letters, [Section] B ;* **98**: No. 1/2, 36-39(1 Jan 1981).

The excitation function of $^{14}C$ + $^{14}C$ elastic scattering at $\Delta$sub(c)sub(m) = 90° from Esub(l)sub(a)sub(b) = 23.4-58.4 MeV shows pronounced oscillations. Angular distributions measured at the maxima of these oscillations show Legendre polynomial behavior of L = 12, 14, 16 and 18.

**34008 Two-proton correlation measurements in 800 and 400 MeV/nucleon heavy-ion reactions.** Tanihata, I.; Lemaire, M.C.; Nagamiya, S.; Schnetzer, S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Physics Letters, [Section] B ;* **97**: No. 3/4, 363-366(15 Dec 1980).

Energy and angular correlations of two protons emitted in collisions of C + C, C + Pb, Ne + NaF, Ar + KCl, at Esup(l)sup(a)sup(b)sub(b)sub(e)sub(a)sub(m) = 800 MeV/A, and NE NaF at Esup(l)sup(a)sup(b)sub(b)sub(e)sub(a)sub(m) = 400 MeV/A have been measured. A strong correlation due to p-p quasielastic scattering is observed except for C + Pb where nuclear shadowing is observed. A simple model is proposed to estimate the magntiude of the knock-out process in these heavy-ion collisions.

**34009 Precision energy measurement of $\gamma$ rays from short-lived activities.** Warburton, E.K.; Alburger, D.E. (Brookhaven National Lab., Upton, NY (USA)). *Nuclear Instruments and Methods ;* **178**: No. 2/3, 443-449(15 Dec 1980).

In the precision energy measurement using Ge(Li) detectors of a $\gamma$ ray emitted following a short-lived $\beta$ activity there are several problems encountered which are not usually of consequence. We consider two of them. First, when using the mixed source technique, the counting rate and the fraction of counts due to the short-lived activity will decrease during the counting cycle and any count rate dependence of the system gain will lead to an error. Second, short lifetimes are usually accompanied by large $\beta$-energies and the associated Doppler effects must be considered. As an example, the energy of the $\gamma$ ray from the first-excited state of $^{11}$B was determined after formation via the $\beta^-$-decay of 13.8 s $^{11}$Be. The result is (2124.473 +- 0.027) keV.

**34010 Evaluation of carbon stripper foils for heavy-ion accelerators.** Auble, R.L.; Bair, J.K.; Galbraith, D.M.; Jones, C.M.; Stelson, P.H.; Weisser, D.C. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods ;* **177**: No. 2/3, 289-294(15 Nov 1980).

Carbon foils of thickness 2-10 $\mu$g/cm$^2$ were produced by vapor deposition and by de glow discharge cracking of hydrocarbon gas. Their lifetimes to mechanical failure, under bombardment with 10 MeV $^{35}$Cl ions, were determined. Foils produced by the glow discharge technique have lifetimes ranging from 5 to over 20 times longer than those produced by vapor deposition. The glow discharge foils are also found to exhibit a strong correlation between lifetime and thickness. Changes in foil thickness with increasing fluence are examined and evidence for sputtering is obtained from beam-scanning.

## 6514 Nuclear Properties And Reactions, A=20-38

*REFER ALSO TO CITATION(S) 34000, 34008*

**34011 High spin resonances in $^{28}Si$ + $^{28}Si$ scattering.** Betts, R.R. (Argonne National Lab., IL (USA)); DiCenzo, S.B.; Petersen, J.F. (Yale Univ., New Haven, CT (USA). Wright Nuclear Structure Lab.). *Physics Letters, [Section] B ;* **100**: No. 2, 117-120(26 Mar 1981).

Angle integrated cross sections for elastic and inelastic scattering of $^{28}Si$ + $^{28}Si$ show structure as a function of energy similar to that previously observed in single-angle excitation functions. Angular distributions for the elastic scattering are well described by pure [Psub(L)(cos theta)]$^2$ shapes with a sequence of angular momenta which closely follows that of the grazing partial wave.

**34012 Classical-equations-of-motion calculations of multiplicities for high-energy collisions of $^{20}Ne$ + $^{20}Ne$.** Bodmer, A.R. (Argonne National Lab., IL (USA); Illinois Univ., Chicago (USA)); Panos, C.N. (Illinois Univ., Chicago (USA)). *Nuclear Physics [Section] A ;* **356**: No. 2, 517-522(23 Mar 1981).

Nucleon multiplicity distributions have been obtained as a function of impact parameter b for $^{20}Ne$ + $^{20}Ne$ at a laboratory energy of 800 MeV nucleon with classical-equations-of-motion calculations. The average multiplicity decreases quite rapidly with b, but there is a quite wide spread of multiplicities for a given b. This indicates, at least for equal-mass, light nuclei, that the multiplicity can only determine the impact parameter with rather poor resolution.

**34013 Elastic and inelastic scattering of 88 MeV $^6Li$ ions.** Fulmer, C.B.; Satchler, G.R.; Gross, E.E.; Bertrand, F.E.; Goodman, C.D.; Hensley, D.C.; Wu, J.R. (Oak Ridge National Lab., TN (USA)); Clarke, N.M.; Steeden, M.F. (King's Coll., London (UK). Wheatstone Physics Lab.). *Nuclear Physics [Section] A ;* **356**: No. 1, 235-259(16 Mar 1981).

The elastic scattering of 88 MeV $^6$Li ions has been studied for eleven targets ranging in mass from $^{24}$Mg to $^{208}$Pb. Angular distributions were measured from about 10° cm in steps of 0.5°, mostly out to 60 or 70° c.m. where the elastic cross sections range from $10^{-3}$ to $10^{-5}$ of the Rutherford values. Inelastic data for exciting the lowest $2^+$ states of $^{24}$sup(,)$^{26}$Mg and $^{60}$Ni were also obtained. The elastic data were analyzed using the optical model, with potentials of both Woods-Saxon and double-folding forms. The analysis confirms that the potentials for $^6$Li obtained from the folding model with the M3Y interaction need renormalizing by about 0.6, in agreement with results obtained at other energies. The inelastic data were compared to distorted-wave calculations. Coupled-channels analyses were also made for $^{24}$sup(,)$^{26}$Mg, $^{60}$Ni and $^{59}$Co. Reorientation effects were found to be important to give the correct $2^+$ angular distributions for $^{24}$sup(,)$^{26}$Mg and could also account for the differences between the elastic scattering from the odd-A and adjacent even-A targets.

## 6515 Nuclear Properties And Reactions, A=39-58

*REFER ALSO TO CITATION(S) 33997, 34000, 34008, 34013, 34033, 34038, 34039*

**34014 Comparison of $\pi$i and $\pi^-$ elastic and inelastic scattering from $^{52}$Cr at 180 MeV.** Egger, J.P.; Goetz, F.; Gretillat, P.; Lunke, C.; Schwarz, E. (Neuchatel Univ. (Switzerland). Inst. de Physique); Perrin, C. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires); Preedom, B.M. (South Carolina Univ., Columbia (USA). Dept. of Physics); Mischke, R.E. (Los Alamos Scientific Lab., NM (USA)). *SIN (Schweizerisches Institut fuer Nuklearforschung) Newsletter ;* No. 13, 7(Nov 1980).

Pion elastic and inelastic scattering to the first excited $2_1^+$ state (Esub(x)=1.43 MeV) in $^{52}$Cr was measured for both $\pi^+$ and $\pi^-$ at an incident pion energy of 180 MeV.

**34015 Yrast spectroscopy: status of yrast isomers, oblate shapes and feeding of yrast states.** Khoo, T.L. (Argonne National Lab., IL (USA)). *Journal de Physique (Paris), Colloque ;* No. , p. 9-17(1980).

From International conference on nuclear behaviour at high angular momentum; Strasbourg, France (22 - 24 Apr 1980).

Three different but related topics are discussed: (i) the status of yrast isomers (restricted to those with A>140 and mainly on the A approximately 150 region); (ii) the nuclear shape along the yrast line; and (iii) the feeding of the yrast states as a function of spin. A recurrent theme is the response of the core to the polarizing effects of a successively increasing number of valence particles and how the investigation of very high spin states bears on this problem.

## 6516 Nuclear Properties And Reactions, A=59-89

*REFER ALSO TO CITATION(S) 34013, 34038*

**34016 Gamma-ray multiplicity moments from $^{86}$Kr reactions on $^{144}$sup(,)$^{154}$Sm at 490 MeV.** Christensen, P.R.; Folkmann, F.; Hansen, O.; Nathan, O.; Trautner, N.; Videbaek, F.; van der Werf, S.Y. (Niels Bohr Inst., Copenhagen (Denmark)); Britt, H.C. (Los Alamos Scientific Lab., NM (USA)); Chestnut, R.P.; Freiesleben, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). *Nuclear Physics* [*Section*] *A ;* **349**: No. 1/2, 217-257(10 Nov 1980).

Gamma-ray multiplicity moments have been measured for reactions induced in the collision systems $^{86}$Kr + $^{144}$Sm and $^{86}$Kr+$^{154}$Sm at 490 MeV lab bombarding energy. Differential cross sections for reaction products from Fe to In were also measured. Angular momentum distribution moments are derived from the multiplicity moments for deep inelastic collisions. The angular momentum transfer results are discussed in terms of the sticking picture and other models for deep inelastic collisions. It is demonstrated that the measured second moments are larger than expected from the standard sticking prescription and may provide a significant test of other models.

## 6517 Nuclear Properties And Reactions, A=90-149

*REFER ALSO TO CITATION(S) 34015, 34016*

**34017 (BNL—29690) Angular-correlation and coincidence studies of excited $0^+$ and other levels in the transitional Ce nuclides $^{142}$Ce, $^{144}$Ce, $^{146}$Ce and $^{148}$Ce.** Walters, W.B.; Chung, C.; Brenner,D.S. (Brookhaven National Lab., Upton, NY (USA); Maryland Univ., College Park (USA); Clark Univ., Worcester, MA (USA)). 1981. Contract AC02-76CH00016. 5p. (CONF-810649—9). NTIS, PC A02/MF A01. Order Number DE81027306.

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The decays of the neutron-rich nuclides $^{142}$La, $^{144}$La, $^{146}$La and $^{148}$La to the levels of the transitional nuclides $^{142}$Ce, $^{144}$Ce, $^{146}$Ce and $^{148}$Ce, respectively, have been studied using mass-separated sources. Angular correlation studies have been employed to identify new excited $0^+$ levels in $^{148}$Ce and support spin and parity assignments for $1^-$, $3^-$, $2^+$, $3^+$, $4^+$ and $6^+$ levels in $^{144}$Ce and $^{146}$Ce. An excited $0^+$ level in $^{148}$Ce is indicated by coincidence ratios and electron studies, while no clear evidence can be found for the location of an excited $0^+$ level below 2 MeV in $^{144}$Ce. The resulting isotonic and isotopic systematics are discussed in terms of the transition from the closed shells at N = 82 and Z = 50 to the region of deformed nuclides.

**34018 (BNL—29949) Experimental determination of anomalous scattering lengths of samarium for thermal neutrons.** Engel, D.W.; Koetzle, T.F. (Associated Universities, Inc., Washington, DC (USA); Durban-Westville Univ. (South Africa); Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 3p. (CONF-810840—3). NTIS, PC A02/MF A01. Order Number DE81030032.

From Symposium on neutron scattering; Argonne, IL, USA (12 Aug 1981).

Anomalous scattering lengths of natural Sm for thermal neutrons with wavelengths between 0.827 and 1.300 A have been determined using a single crysrtal of a Sm-complex of known structure. 140 selected reflections were measured at each wavelength and $b_0 + b'$ and $b''$ refined in each case. The values obtained are in good agreement with theoretical values obtained from a Breit-Wigner calculation using tabulated resonance parameters for $^{149}$Sm. A value of $b_0$ = 4.3 +- 0.2 fm is deduced from the diffraction experiment.

**34019 (ORNL/TM—7295) Description and use of the Monte Carlo code LILITA.** Gomez del Campo, J.; Stokstad, R.G. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 42p. NTIS, PC A03/MF A01. Order Number DE81030704.

The computer code LILITA models the equilibrium decay of the primary reaction products of heavy-ion collisions. Two major applications of the code have been developed. The first is the prediction of relative yields, energy spectra and angular distributions of evaporation residues and light particles (alphas, protons and neutrons) produced in a heavy-ion compound-nuclear reaction. The second consists of modeling the equilibrium decay of excited fragments produced in a two-body collision (such as quasi-elastic or deep inelastic scattering). The equilibrium decay of the reaction products is calculated by using the Hauser-Feshbach formula in conjunction with the Monte Carlo method, and the results are given in the laboratory system - in either singles or coincidence modes. The code can generate the results in both histogram and event-by-event formats to suit the application of the user. The approximations used in evaluating the Hauser-Feshbach formula and its use in conjunction with the Monte Carlo method are described. A description of the program input and a discussion of the event-by-event calculations are given. The processing of the event-by-event file used for coincidence calculations, either for fusion reactions or for two-body inelastic collisions is described. Comments on the parameters used for the statistical model calculations are given, and in the Appendix the flow diagram of the code is discussed.

**34020 Energy systematics of the giant Gamow-Teller resonance and a charge-exchange dipole spin-flip resonance.** Horen, D.J.; Goodman, C.D. (Oak Ridge National Lab., TN (USA)); Bainum, D.E. (Emporia State Univ., KS (USA)); Foster, C.C. (Indiana Univ., Bloomington (USA)); Gaarde, C. (Niels Bohr Inst., Copenhagen (Denmark)); Goulding, C.A.; Greenfield, M.B. (Florida State Univ., Tallahassee (USA)); Rapaport, J.; Taddeucci, T.N. (Ohio Univ., Athens (USA)); Sugarbaker, E. (Colorado Univ., Boulder (USA)). *Physics Letters,* [*Section*] *B ;* **99**: No. 5, 383-386(5 Mar 1981).

Energy systematics of the giant Gamow-Teller resonance and a charge-exchange resonance excited by a L = 1, S = 1 interaction are presented. Plots of the energy separation between each resonance and the IAS versus (N-Z)/A can be represented approximately by linear functions.

**34021 $^{136}$sup(,)$^{138}$Ba(t,p) and the systematics of neutron pairing vibrations at N = 82.** Flynn, E.R.; Cizewski, J.A.; Brown, R.E.; Sunier, J.W. (Los Alamos Scientific Lab., NM (USA)). *Physics Letters,* [*Section*] *B ;* **98**: No. 3, 166-168(8 Jan 1981).

The $^{136}$sup(,)$^{138}$Ba (t,p) reaction has been studied at Esub(t) = 17 MeV. The neutron monopole and quadrupole pairing vibra-

tion states were located in $^{138}$Ba at 3.612 MeV and 4.043 MeV, respectively. These results, when combined with previous observations in the Ce and Nd isotopes at the N = 82 closed shell, lead to a linear relationship between the two-neutron binding energies and the proton number. Predictions of locations of other pairing vibration states at the N = 82 shell are possible from these relations.

## 6518 Nuclear Properties And Reactions, A=150-189

*REFER ALSO TO CITATION(S) 34016, 34020*

**34022 Nuclear structure of $^{161}$sup(,)$^{163}$Ho studied with the (t vector,α) reaction.** Burke, D.G.; Hammaren, E. (McMaster Univ., Hamilton, Ontario (Canada). Tandem Accelerator Lab.); Lovhoiden, G. (Bergen Univ. (Norway)); Cizewski, J.A.; Flynn, E.R.; Sunier, J.W. (Los Alamos Scientific Lab., NM (USA)). *Nuclear Physics* [*Section*] *A ;* **359**: No. 1, 36-60(20 Apr 1981).

The $^{162}$sup(,)$^{164}$Er(t vector,α)$^{161}$sup(,)$^{163}$Ho reactions have been studied using a beam of 17 MeV polarized tritons from the tandem Van de Graaff accelerator at the Los Alamos Scientific Laboratory. The reaction products were analyzed with a Q3D magnetic spectrometer using a helical-cathode position-sensitive detector in the focal plane. Comparisons of the measured angular distributions of cross sections and analyzing powers with DWBA predictions made it possible to assign spins and parities to a number of previously unknown levels in each residual nucleus. The results are interpreted in the framework of the Nilsson model with pairing and Coriolis mixing effects included. The 7/2$^-$[523], 1/2$^+$[411], 3/2$^+$[411], 7/2$^+$[404], 5/2$^+$[413], 5/2$^-$[532] and 1/2$^+$[420] bands were observed in both $^{161}$Ho and $^{163}$Ho. In previous stripping reaction studies anomalously large strengths were reported for the 33/22$^+$[411] and 51/22$^+$[411] states, apparently because of unusually strong mixing with the 31/22$^+$[411] and 53/22$^+$[411] states, respectively. In the present work the pickup strengths to these states are also found to be larger than expected. A new Coriolis mixing calculation with revised parameters is capable of explaining part, but not all, of the mixing effects. In particular the very large strength of the 33/22$^+$[411] state in $^{163}$Ho remains unexplained.

**34023 Identification of all intrinsic excitations below 2 MeV in $^{168}$Er.** Davidson, W.F.; Warner, D.D. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)); Casten, R.F. (Brookhaven National Lab., Upton, NY (USA)) (and others). *Journal of Physics G: Nuclear Physics ;* **7**: No. 4, 455-528(Apr 1981).

The levels and γ decay in $^{168}$Er have been investigated following thermal neutron capture on enriched targets of $^{167}Er_2O_3$. Precision measurements of the γ spectrum with curved-crystal spectrometers revealed over 700 transitions up to an energy of 2.5 MeV, with intensities spanning five orders of magnitude. A list of primary γ transitions populating levels in $^{169}$Er up to an excitation energy of 3.1 MeV resulted from measurements with the pair spectrometer. Information on the γ spectrum in the energy region 1400 < E < 2600 keV was obtained using a Ge(Li) spectrometer. The conversion electron spectrum up to 2.2 MeV electron energy was measured with a β spectrometer. These data were supplemented by γ-γ coincidences involving the feeding of the 112 ns 4$^-$ isomer at 1094 keV excitation. Average resonance capture measurements at neutron energies of 2 keV and 24 keV were made to complete the set of spin 2-5 levels below about 2.2 MeV.

**34024 α-decay rate of $^{188}$Pb.** Toth, K.S.; Ellis-Akovali, Y.A.; Moltz, D.M. (Oak Ridge National Lab., TN (USA)); Bingham, C.R. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)); Carter, H.K. (UNISOR, Oak Ridge, TN (USA)); Sousa, D.C. (Eastern Kentucky Univ., Richmond (USA)). *Nuclear Physics* [*Section*] *A ;* **356**: No. 1, 26-32(16 Mar 1981).

As part of our investigation of the reported anomalous α-decay rates of even-even lead nuclei with A <= 192 we have measured the α-decay branching ratio of $^{188}$Pb. The isotope was produced in the $^{180}$W($^{16}$O,8n) reactions, and its decay properties were investigated with the use of the Oak Ridge on-line isotope separator facility. Gamma-ray and α-particle spectra were measured with the detectors placed in calibrated geometries. From these measurements the $^{188}$Pb α-decay branching ratio was determined to be (22 +- 7)%, a value about seven times greater than that available in the literature. This result, together with our recent data for $^{190}$Pb and $^{192}$Pb, is discussed within the context of α-decay-rate systematics in the lead region.

**34025 Multiple Coulomb polarization potential for heavy ion scattering.** Carlson, B.V.; Hussein, M.S. (Wisconsin Univ., Madison (USA). Dept. of Physics); Baltz, A.J. (Brookhaven National Lab., Upton, NY (USA)). *Physics Letters,* [*Section*] *B ;* **98**: No. 6, 409-412(29 Jan 1981).

The component in the heavy ion optical potential due to the Coulomb coupling to inelastic channels has been calculated using the on-energy-shell approximation for the intermediate channel Green's functions. Closed form expressions including reorientation in the 2$^+$ state and coupling to the 4$^+$ state to all orders are included in the elastic scattering calculations as a test of this general approach for coupling to higher states. Comparison with coupled channels calculations indicate the increasing importance of off-shell effects with increasing coupling strength. An analytical estimate of off-shell effects is presented.

**34026 $^{176}$Lu(t,p)$^{178}$Lu reaction. The influence of shell gaps and blocking on L = 0 strenght.** Girshick, F.; Krien, K.; Naumann, R.A. (Princeton Univ., NJ (USA). Dept. of Chemistry; Princeton Univ., NJ (USA). Dept. of Physics); Struble, G.L.; Lanier, R.G.; Mann, L.G. (California Univ., Livermore (USA). Nuclear Chemistry Div.); Cizewki, J.A.; Flynn, E.R. (Los Alamos Scientific Lab., NM (USA). Physics Div.); Nail, T. *Physics Letters,* [*Section*] *B ;* **98**: No. 1/2, 29-32(1 Jan 1981).

The $^{176}$Lu(t,p)$^{178}$Lu reaction shows two levels, at 98 +- 40 and 1329 +- 40 keV, which are strongly populated by L = 0 transitions. The ratio of intensities for these two states is 0.85. This is larger than any comparable ratio of two-neutron transfer strengths in the rare-earth or actinide regions of deformation. Yet the cross sections are nearly a factor of two smaller than cross sections for comparable states in even-even nuclei. The explanation of our results requires a detailed analysis of both the shape and pairing degrees of freedom.

## 6519 Nuclear Properties And Reactions, A=190-219

*REFER ALSO TO CITATION(S) 33997, 34000, 34008, 34013, 34020, 34028, 34039*

**34027 Very slow M4 transitions and shell-model intruder states in $^{199}$sup(,)$^{201}$Bi.** Braga, R.A.; Western, W.R.; Wood, J.L.; Fink, R.W. (Georgia Inst. of Tech., Atlanta (USA). School of Chemistry); Stone, R.; Bingham, C.R.; Riedinger, L.L. (Tennessee Univ., Knoxville (USA). Dept. of Physics; Oak Ridge National Lab., TN (USA)). *Nuclear Physics* [*Section*] *A ;* **349**: No. 1/2, 61-67(1980).

The isomeric decays of the 1/2$^+$ shell-model intruder states in $^{199}$sup(,)$^{201}$Bi have been investigated. In the case of $^{201}$Bi we show that the $s_1$sub(/)$_2$ → $h_9$sub(/)$_2$ isomeric transition is pure M4 within experimental error and is 2200 times slower than any other M4 transition observed in odd-mass nuclei. Its l-forbiddenness and the possibility of an E5 admixture and penetration effects are discussed.

## 6520 Nuclear Properties And Reactions, A=220 And Above

**34028 (ORNL/TM—7883) PAPIN: A Fortran-IV program to calculate cross section probability tables, Bondarenko and transmission self-shielding factors for fertile isotopes in the unresolved resonance region.** Munoz-Cobos, J.G. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 41p. (ENDF—310). NTIS, PC A03/MF A01. Order Number DE81030436.

The Fortran IV code PAPIN has been developed to calculate cross section probability tables, Bondarenko self-shielding factors and average self-indication ratios for non-fissile isotopes, below

the inelastic threshold, on the basis of the ENDF/B prescriptions for the unresolved resonance region. Monte-Carlo methods are utilized to generate ladders of resonance parameters in the unresolved resonance region, from average resonance parameters and their appropriate distribution functions. The neutron cross-sections are calculated by the single level Breit-Wigner (SLBW) formalism, with s, p and d-wave contributions. The cross section probability tables are constructed by sampling the Doppler-broadened cross sections. The various self-shielded factors are computed numerically as Lebesgue integrals over the cross section probability tables. The program PAPIN has been validated through extensive comparisons with several deterministic codes.

34029 **Recent searches for superheavy elements in deep-inelastic reactions.** Hulet, E.K.; Lougheed, R.W.; Nitschke, J.M. (California Univ., Livermore (USA). Lawrence Livermore Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.; Oak Ridge National Lab., TN (USA)) (and others). *Pure and Applied Chemistry ;* **53**: No. 5, 965-972(May 1981).

From International symposium on the synthesis and properties of new elements; Dubna, USSR (23 - 27 Sep 1980).

New attempts have been made to synthesize superheavy elements (SHE) by nuclear reactions that may possibly form the products at low excitation energies. Survival of the superheavy elements would then be enhanced because of reduced losses from prompt fission. Classical and diffusion model calculations of deep-inelastic reactions indicate there should be detectable yields of SHE formed with less than 30 MeV of excitation energy. Accordingly, superheavy elements have been sought in such reactions where targets of $^{248}$Cm and $^{238}$U have been irradiated with $^{136}$Xe and $^{238}$U ions. In the most recent experiments, targets of $^{248}$Cm metal were bombarded with 1.8-GeV $^{238}$U ions from the UNILAC accelerator. The longer-lived SHE's and actinides near the target Z were chemically separated and the yields of a number of isotopes of Bk, Cf, Es, and Fm were measured. An upper limit of 30 nb was obtained for the formation of 1-h $^{259}$No. In addition to the off-line chemical recovery and search for SHE's an on-line experiment was performed to detect volatile SHE's with half lives of a minute or more. All experiments to produce and detect superheavy elements were much less than optimum because of premature failures in the Cm-metal targets. The outcome and status of these experiments, and the implications of the actinide yields in estimating the chances for forming superheavy elements in the $^{248}$Cm + $^{238}$U reactions are discussed.

34030 **Kinetic energy deficit in the symmetric fission of $^{259}$Md.** Hulet, E.K.; Wild, J.F.; Lougheed, R.W.; Baisden, P.A.; Dougan, R.J.; Mustafa, M.G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). *Pure and Applied Chemistry ;* **53**: No. 5, 973-978(May 1981).

From International symposium on the synthesis and properties of new elements; Dubna, USSR (23 - 27 Sep 1980).

The fragment energies of about 725 coincidence events have now been observed in the spontaneous fission (SF) decay of 105-min $^{259}$Md since its discovery in 1977. The fission of $^{259}$Md is characterized by a symmetric mass distribution, similar to those of $^{258}$Fm and $^{260}$Fm, but with a broad total kinetic energy (TKE) distribution which peaks at about 195 MeV, in contrast to those of $^{256}$Fm and $^{259}$Fm, for which the TKE is about 240 MeV. It is postulated that this kinetic energy deficit, approximately 40 MeV, is due to the emission of hydrogen-like particles by $^{259}$Md at the scission point in a large fraction of the fissions, leaving the residual fissioning nucleus with 100 protons. The residual nucleus would then be able to divide into two ultrastable tin-like fission fragments, but with less kinetic energy than that observed in the SF of $^{258}$Fm and $^{260}$Fm, due to binding-energy losses and a reduction in the Coulomb repulsion of the major fragments. To test this hypothesis, counter-telescope experiments aimed at detecting and identifying these light particles have been performed. In 439 SF events 3 + 3 protons of the appropriate energy were observed, too few to account for the kinetic energy deficit in the fission of $^{259}$Md. There seems to be no explanation for this problem within the framework of current fission theory. These results are discussed along with preliminary measurements of light-particle emission in the SF of $^{256}$Fm.

34031 **Search for an 80 ms spontaneous fission activity in bombardments of $^{249}$Bk with $^{15}$N.** Nitschke, J.M.; Fowler, M.; Ghiorso, A.; Leber, R.E.; Leino, M.E.; Nurmia, M.J.; Somerville, L.P.; Williams, K.E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); Hulet, E. K.; Landrum, J.H. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Physics [Section] A ;* **352**: No. 1, 138-146(26 Jan 1981).

A rotating drum system was used to search for an 80 ms spontaneous fission (sf) activity in the reaction of $^{15}$N with $^{249}$Bk. No such activity was found beyond a cross section limit of 0.5 nb. A sf activity with a half-life of 23 +- 2 ms and a maximum formation cross section of 19 +- 4 nb at 82 MeV was observed. The identity of this activity has not been determined.

## 6530 Nuclear Theory

34032 **Calculation of correlation functions in nuclear matter.** Wiringa, R.B. (Los Alamos Scientific Lab., NM (USA)); Pandharipande, V.R. (Illinois Univ., Urbana (USA)). *Physics Letters, [Section] B ;* **99**: No. 1, 1-4(5 Feb 1981).

A new three-parameter set of nuclear matter correlation functions is generated by two-body Euler-Lagrange equations. The parameters include two correlation ranges, d for central, sigma$_1$ x sigma$_2$, tau$_1$ x tau$_2$ and (sigma$_1$ x sigma$_2$)(tau$_1$ x tau$_2$) correlations, and dsub(t) for tensor correlations. A new parameter $\alpha$ that simulates the quenching of noncentral interactions in matter is introduced. Simple physical arguments indicate that this parameterization is more appropriate. The new correlation functions give 2-3 MeV lower energies for the semirealistic $v_6$ models at equilibrium density.

34033 **Role of the attractive nuclear potential in determining reaction cross sections.** Brink, D.M.; Satchler, G.R. (Oak Ridge National Lab., TN (USA)). *Journal of Physics G: Nuclear Physics ;* **7**: No. 1, 43-52(Jan 1981).

The effects of refraction by the attractive nuclear potential in enhancing reaction cross sections at moderately low energies (approximately equal to 10 MeV/nucleon) are studied. While the effect is appreciable, it is not enough to account for the recently observed excess of cross section at these energies compared with much higher energies (several 100 MeV/nucleon). The effects of the real potential are embodied in a simple semiclassical expression.

34034 **Finite region density increase effects in the Lee-Wick model.** Kroeger, H. (Oak Ridge National Lab., TN (USA). Physics Div.). *Physics Letters, [Section] B ;* **97**: No. 3/4, 346-350(15 Dec 1980).

We investigate the effect of nuclear density increase in a finite space-time region. Field theoretical treatment of the nucleon field but classical treatment of the mesonic field leads to a solvable interaction of pair theory type in the nuclear field. A mesonic soliton solution is discussed. Energy transfer into the nucleon field is calculated.

34035 **Angular momentum effects in fusion-fission and fusion-evaporation reactions.** Plasil, F. (Oak Ridge National Lab., TN (USA)). *Journal de Physique (Paris), Colloque ;* No. , p. 183-199(1980).

From International conference on nuclear behaviour at high angular momentum; Strasbourg, France (22 - 24 Apr 1980).

Two different mechanisms may contribute to observed heavy-ion-induced fission: one is compound nucleus fission and the other fission-fission. There is a large amount of evidence that many evaporation residues do not result from the deexcitation of products of partial fusion. A large part of this paper deals with questions regarding the identity of fusion reactions. The various types of heavy-ion-induced fission are discussed. Compound nucleus fission is considered with reference to fission barriers deduced from heavy-ion-induced fission. Problems associated with measured values of cross sections for evaporation residues and on the angular momentum dependence of incomplete fusion are examined. Finally the deexcitation of compound nuclei is considered.

## 6540 Radiation And Shielding Physics

*REFER ALSO TO CITATION(S) 34043*

34036 **(BNL—29922) Polarizing multilayer spectrometer for neutrons.** Majkrzak, C.F.; Passell, L.; Saxena, A.M. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 8p. (CONF-810840—2). NTIS, PC A02/MF A01. Order Number DE81029546.

From Symposium on neutron scattering; Argonne, IL, USA (12 Aug 1981).

Polarizing neutron monochromators were prepared by sputtering thin-film multilayers with d-spacings from 40 to 85A on large float-glass substrates. Peak reflectivities as great as 90% and polarizing efficiencies of 98% were measured. Increased angular acceptances were obtained by fabricating multilayers with multiple d-spacings. A planned polarized beam spectrometer which incorporates the multilayers and which has a variable energy resolution independent of angular beam divergence is described.

34037 **(BNL—30004) Neutron scattering studies of quasi one- and two-dimensional hydrogen-bonded ferroelectrics.** Youngblood, R.W. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 9p. (CONF-810863—2). NTIS, PC A02/MF A01. Order Number DE81030334.

From 5. international meeting on ferroelectricity; University Park, PA, USA (17 Aug 1981).

Neutron scattering studies of cooperative ordering in the hydrogen bond networks of stannous chloride dihydrate (SCD), copper formate tetrahydrate (CPT), and cesium dihydrogen phosphate (CDP) are reviewed. In each case, there is an interesting nontrivial comparison to be made with an exactly solvable lattice model.

34038 **(BNL-NCS—51346) Ni elemental neutron induced reaction cross-section evaluation.** Divadeenam, M. (Brookhaven National Lab., Upton, NY (USA)). Mar 1979. Contract AC02-76CH00016. 103p. (ENDF—294). NTIS, PC A06/MF A01. Order Number DE81030205.

A completely new evaluation of the nickel neutron induced reaction cross sections was undertaken as a part of the ENDF/B-V effort. (n,xy) reactions and capture reaction time from threshold to 20 MeV were considered for $^{58\ 60\ 61\ 62\ 64}$Ni isotopes to construct the corresponding reaction cross section for natural nickel. Both experimental and theoretical calculated results were used in evaluating different partial cross sections. Precompound effects were included in calculating (n,xy) reaction cross sections. Experimentally measured total section data extending from 0.7 MeV to 20 MeV were used to generate smooth cross section. Below 0.7 to MeV elastic and capture cross sections are represented by resonance parameters. Inelastic angular distributions to the discrete isotopic levels and elemental elastic angular distributions are included in the evaluated data file. Gamma production cross sections and energy distribution due to capture and the (n,xy) reactions were evaluated from experimental data. Finally, error files are constructed for all partial cross sections.

34039 **(BNL-NCS—51388) Neutron capture cross section standards for BNL 325, Fourth Edition.** Holden, N.E. (Brookhaven National Lab., Upton, NY (USA)). Jan 1981. Contract AC02-76CH00016. 58p. NTIS, PC A04/MF A01. Order Number DE81030196.

This report evaluates the experimental data and recommends values for the thermal neutron cross sections and resonance integrals for the neutron capture reactions: $^{55}$Mn(n,γ), $^{59}$Co(n,γ) and $^{197}$Au(n,γ). The failure of lithium and boron as standards due to the natural variation of the absorption cross sections of these elements is discussed. The Westcott convention, which describes the neutron spectrum as a thermal Maxwellian distribution with an epithermal component, is also discussed.

34040 **High-current deuterium gas target for neutron nuclear data research.** Meadows, J.W.; Smith, D.L.; Winkler, G. (Argonne National Lab., IL (USA). Applied Physics Div.). *Nuclear Instruments and Methods ;* **176**: No. 3, 439-442(15 Oct 1980).

34041 **Monte Carlo computer program for the transport of energetic ions in amorphous targets.** Biersack, J.P. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)); Haggmark, L.G. (Sandia Labs., Livermore, CA (USA)). *Nuclear Instruments and Methods ;* **174**: No. 1/2, 257-269(Aug 1980).

The formalism for a Monte Carlo computer program which simulates slowing down and scattering of energetic ions in amorphous targets is presented. It was developed for determining ion range and damage distributions as well as angular and energy distributions of backscattered and transmitted ions. The computer program provides particularly high computer efficiency, while still maintaining a high degree of accuracy. This is achieved mainly by applying a new analytic formula for determining nuclear scattering angles based on the Moliere potential, and by suitably expanding the distance between collisions at high energies. With these improvements it becomes feasible for the first time to assess accurately both low and high energy problems with high precision using a single simulation program.

## 6550 Medical Physics

34042 **(PNL-SA—9317) Dose/response relationships and policy formulation.** Robinson, P.D. (Pacific Northwest Lab., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 13p. (CONF-8106144—6). NTIS, PC A02/MF A01. Order Number DE81030102.

From Health Physics Society annual meeting; Louisville, KY, USA (21 Jun 1981).

The ICRP 26 cost/benefit approach to establishing operational radiation protection guidelines is discussed. The purpose is to aid the policy maker in the decision making process, using as a basis the dose-response curve. (ACR)

## 6560 Solid State Physics

*REFER ALSO TO CITATION(S) 33953*

34043 **(BNL—30037) Soft phonons and magnetic ordering in the γ-phase transition metal alloys Fe/sub 1-x/Pd/sub x/.** Sato, M.; Grier, B.H.; Shapiro, S.M.; Miyajima, H. (Brookhaven National Lab., Upton, NY (USA); Tokyo Univ. (Japan). Inst. for Solid State Physics). 1981. Contract AC02-76CH00016. 4p. (CONF-810872—1). NTIS, PC A02/MF A01. Order Number DE81030524.

From International conference on phonon physics; Bloomington, IN, USA (30 Aug 1981).

Neutron inelastic scattering measurements have been performed on two single crystals of the thermally quenched γ-phase (fcc) alloy, Fe/sub 1-x/Pd/sub x/ with x = 0.28 and x = 0.37. The x = 0.28 sample which orders ferromagnetically at T/sub c/ = 575 K exhibits a smeared structural transition into an fct phase near T/sub M/ = 265 K. An anomalous dispersion of the [ξξ0]TA1 branch due to the decrease of the phonon energy around the Γ point develops below T/sub c/. As the temperature decreases, the branch decreases in energy. The anomalous part of the elastic constant, $\Delta(C_{11}-C_{12})/2$, follows the same temperature dependence as the square of the magnetization. On the x = 0.37 sample which has no structure transition, the phonon anomaly is much weaker. For both crystals the other branches exhibit normal behavior.

34044 **(LA—8921-MS) Finite element analysis of the split Hopkinson bar.** Kramer, M.J. (Los Alamos National Lab., NM (USA)). Jul 1981. Contract W-7405-ENG-36. 30p. NTIS, PC A03/MF A01. Order Number DE81030387.

The finite element method was investigated for its ability to analyze the split Hopkinson bar apparatus used in studying the dynamic properties of materials. This is a stress-wave problem in two dimensions complicated by material interfaces. The finite element

method has not been widely used in studying transient problems, particularly the wave phenomena found in cylindrical bars. An explicit isoparametric finite element computer code, HONDO, was investigated for its accuracy in solving stress-wave propagation problems in cylindrical bars in one and two dimensions. Once verified, HONDO was then checked against a two-dimensional finite difference wave code, TOODY, for solution accuracy and computational time in analyzing the split Hopkinson bar. HONDO is capable of using fewer mesh points than TOODY. While computer time is comparable, HONDO requires less storage, an advantage to experimentalists with smaller computer facilities.

34045 (LBL—12000, pp 183-225) **Materials chemistry.** Phillips, N.E. Jun 1981. NTIS, PC A24/MF A01. Order Number DE81027828.

In Materials and Molecular Research Division annual report 1980.

Subject areas covered include: low-temperature properties of materials; spin glass state; electrochemical processes; high temperature thermodynamics; chemistry and materials problems in energy production technologies; plasma-enhanced deposition of thin films; electrochemical phase boundaries; solid-state and surface reactions; and nuclear magnetic resonance. (GHT)

34046 **(SAND—81-1151C) Recent advances in the study of structural phase transitions at high pressure.** Samara, G.A. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 8p. (CONF-810828—6). NTIS, PC A02/MF A01. Order Number DE81030206.

From Conference on high pressure physics; Bad Honnef, F.R. Germany (Aug 1981).

The role of pressure in the study and understanding of some structural phase transitions in solids is discussed. Results on a number of crystals exhibiting displacive, order-disorder and cooperative Jahn-Teller transitions are presented. The occurrence of each type of these transitions is determined by a balance between competing interactions, and pressure alters this balance and allows tests of our understanding of the physical phenomena involved. Some emphasis is on displacive transitions especially with regard to incommensurate structures and the behavior near the so-called displacive limit. This limit is the special case where the transition temperature T/sub c/ = 0°K. As T/sub c/ decreases and approaches 0°K quantum effects can be expected to come into play. Pressure turns out to be an excellent variable to study the crossover from classical to quantum behavior expected on approaching the displacive limit.

### 6561 Superconductivity

34047 **(CONF-800877—3) Electrical property studies of oxygen in Czochralski-grown neutron-transmutation-doped silicon.** Cleland, J.W.; Fukuoka, N. (Oak Ridge National Lab., TN (USA)). Oct 1980. Contract W-7405-ENG-26. 30p. NTIS, PC A03/MF A01. Order Number DE81028143.

From 3. international conference on NTD-silicon; Copenhagen, Denmark (27 Aug 1980).

Electically active oxygen-related donors can be formed in Czochralski (Cz) Si either during crystal growth or during subsequent heat treatment; conventional n- or p-type dopant carrier concentrations are altered if these oxygen donors are present. Neutron transmutation doping (NTD) has been used to introduce a uniform concentration of $^{31}P$ in Si. However, oxygen donors can also be formed in NTD Cz Si during the process of annealing to remove NTD radiation damage. In the present experiments, the carrier concentration of Cz and NTD Cz Si samples was determined as a function of the initial dopant, oxygen, and $^{31}P$ concentration before and after isothermal or isochronal annealing. It is shown that low temperature (350 to 500°C) heat treatment can introduce a significant oxygen donor concentration in Cz Si and in NTD Cz Si that contains radiation-induced lattice defects. Intermediate temperature (550 to 750°C) heat treatment, which is intended to remove oxygen donors or lattice defects, can introduce other oxygen donors; annealing above 750°C is required to remove any of these oxygen donors. Extended (20 h) high-temperature (1000 to 1200°C) annealing can remove oxygen donors and lattice defects, but a significant concentration of oxygen donors can still be introduced by subsequent low temperature heat treatment. These results suggest that oxygen-related donor formation in NTD Cz Si at temperatures below 750°C may serve to mask any annealing study of lattice defects. It is concluded that annealing for 30 min at 750°C is sufficient to remove radiation damage in NTD Cz Si when the separate effects of oxygen donor formation are included.

34048 **Hill plots and americium.** Smith, J.L. (Los Alamos Scientific Lab., NM (USA)). *Physica B+C (Amsterdam)* ; **102**: No. 1-3, 22-24(Oct-Dec 1980).

The reasons for the success of the Hill plot in predicting magnetism and superconductivity in Ce, U, Np, and Pu are reviewed. Some limitations and extensions are discussed. The critical spacing of Am is calculated to be 3.26 Angstroem.

### 6570 Theoretical Physics

*REFER ALSO TO CITATION(S) 34194*

34049 **(DOE/ER/03992—448) Dirac's new relativistic wave equation in interaction with an electromagnetic field.** Mukunda, N.; Chiang, C.C.; Sudarshan, E.C.G. (Texas Univ., Austin (USA). Center for Particle Theory). May 1981. Contract AC05-76ER03992. 11p. NTIS, PC A02/MF A01. Order Number DE81028472.

The present generalization of the work of Dirac provides a relativistic wave equation for a spinless particle of finite mass capable of interacting with the electromagnetic field. The inconsistency of Dirac's equation is avoided by having a more complex structure for the particle. It would be interesting to study in detail the electromagnetic form factor for such a particle.

### 6580 Mathematical Physics

34050 **Least squares method for analyzing broadened X-ray line shapes.** Howell, R.H.; Matthews, D.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). *Journal of Quantitative Spectroscopy and Radiative Transfer* ; **23**: No. 5, 513-515(May 1980).

A method for obtaining values of the widths and other parameters describing the Gaussian and Lorentzian components of peaks, which have the shape of the convolution of those functions, is described. Results of the method are given for X-ray data containing several peaks with different ratios of the composite widths in separate spectra.

## 70 FUSION ENERGY

### 7001 Plasma Research

34051 (CONF-801011—(Vol.1), pp 61-66) **Flux of hydrogen from tokamak devices.** Cohen, S.A.; Voss, D.E. (Princeton Univ., NJ). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Energetic hydrogen ions which comprise tokamak plasmas are lost dominantly by the processes of charge exchange and plasma transport. The resulting outflux bombards surfaces at the plasma edge. Analysis of these particles gives information on the plasma properties such as ion temperature, particle confinement and heat transport, and on the plasma contamination mechanisms of sputtering and desorption. This paper presents recent results on the energy spectrum of ions and neutrals which impact the tokamak limiter and walls and discusses their importance to tokamak behavior. These experiments, performed with newly developed surface probes and time-of-flight detectors, show that the flux of ions at the plasma edge exceeds $10^{18}$ $cm^{-2}$ $s^{-1}$ at typical energies of 50 to 500 eV and that the flux of neutral hydrogen at the wall away from the limiter is typically $10^{14}$ $cm^{-2}$ $s^{-1}$ with average neutral energies of 200 eV. Modifications to currently used models of plasma recycling are proposed.

34052 (CONF-801011—(Vol.1), pp 254-260) **Enhanced fusion product heating via the fast magnetosonic instability.** Sutton, W.R.; Choi, C.K.; Miley, G.H. (Univ. of Illinois, Urbana). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Plasma kinetic instabilities that cause anamolously rapid slowing down of fusion products may arise under certain conditions. Once initiated such an instability is likely to be periodic in time. The resulting enhancements of alpha particle-plasma ion heating rates are studied for fast magnetosonic modes (FMS) (k/sub parallel to/ and k/sub perpendicular to/ propagation) as a function of minor radius in a tokamak. An engineering model of potential plasma heating is proposed. It is shown that alpha-ion heating rates may be enhanced by a factor ~ 1.5 for k/sub perpendicular to/ propagation of the FMS mode while potential enhancement of electrons is negligible. Equilibrium of ion and electron temperatures is not considered.

34053 (CONF-801011—(Vol.3), pp 788-794) **Fusion energy calorimeter for the tokamak fusion test reactor.** Jassby, D.L.; Imel, G.R. (Princeton Univ., NJ). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

One and two-dimensional neutronic analyses treating the transport and scattering of neutrons and the production and transport of gamma rays in the TFTR demonstrate that the fusion energy production in a D-T pulse in the TFTR can be determined with an uncertainty of +-15% or less, simply by integrating the measured profile of temperature increase along the central radial axis of a large hydrocarbon moderator that fills the bay between adjacent toroidal-field coils, just outside the vacuum vessel. Limitations in thermopile temperature measurements dictate a minimum fusion-neutron fluence at the vacuum vessel of the order of $10^{12}$ n/cm$^2$ per pulse (a source strength of $10^{18}$ n/pulse in TFTR), in order that this simple calorimeter can provide useful accuracy.

34054 (CONF-801011—(Vol.3), pp 854-857) **Ideal mhd stable startup and burn for the reversed field pinch.** Nebel, R.A.; Moses, R.W.; Miley, G.H. (Univ. of Illinois, Urbana). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A problem with conventioanl start-up of a Reversed Field Pinch (RFP) is that large plasma and energy losses are encountered during the turbulent period when reversal occurs. One way to prevent these losses is to program the injection of cold fuel and variations in the external magnetic field such that stable profiles are maintained throughout startup. This technique has been called pitch convection since the desired pitch profile is created continously be external programming. Requirements for such a startup are described and reactor implications discussed.

34055 (CONF-801011—(Vol.3), pp 1066-1073) **Effect of impurities and ripple upon power regulation in self-sustained tokamaks.** Bromberg, L.; Cohn, D.R. (Massachusetts Inst. of Tech., Cambridge). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Tokamak power reactors will likely operate in a self sustained heating mode where additional power losses are introduced to permit higher levels of alpha particle heating (and thus higher levels of total fusion power) at thermal equilibrium. Illustrative 0-dimensional calculations are made to assess requirements for power regulation of self sustained tokamak plasmas by the use of impurity radiation. Effects of impurities upon allowable fuel density and thermal stability are determined. Requirements are calculated for passive thermal stability control by temperature driven radial motion in the presence of ripple transport losses; it appears that stability might be attained over a relatively wide temperature range with a small amount of ripple transport loss. Requirements for power regulation by the use of ripple transport are also determined.

34056 **(CONF-810831—52) High-speed photographic observation of plasma-limiter interactions in ISX-B.** Clausing, R.E.; Emerson, L.C.; Heatherly, L. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE81029669.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

High-speed motion pictures confirm that arcing occurs during periods of plasma instability in ISX-B. Various types of plasma-limiter interactions are described and illustrated. Arcing and other visible phenomena are correlated to plasma parameters.

34057 **(DOE/ET/53036—25) Kinetic theory of Alfven wave heating.** Ross, D.W.; Chen, G.L.; Mahajan, S.M. (Texas Univ., Austin (USA). Fusion Research Center). Feb 1981. Contract AC05-76ET53036. 7p. (CONF-810214—10). NTIS, PC A02/MF A01. Order Number DE81029777.

From 4. topical conference on radio frequency plasma heating; Austin, TX, USA (9 Feb 1981).

The heating of tokamak plasmas by Alfven waves is studied in cylindrical geometry using linearized kinetic equations. The energy deposition and density fluctuations as functions of the plasma radius, as well as the total impedance for the experiments on the PRETEXT tokamak are computed. Optimum conditions for heating are investigated.

34058 **(GA-A—16400) Algorithms developed to obtain particular numerical solutions to the ideal MHD equilibrium problem.** Wang, T.S.; Helton, F.J. (General Atomic Co., San Diego, CA (USA)). Jul 1981. Contract AT03-76ET51011. 31p. (CONF-810947—3). NTIS, PC A03/MF A01. Order Number DE81029891.

From European workshop on the behavior of magnetically-confined plasmas; Wildhaus, Switzerland (9 Sep 1981).

The determination of axially symmetric MHD equilibria with free plasma-vacuum interface requires the solution of a two-dimensional, elliptic, nonlinear partial differential equation. The shape of the boundary is not specified but is determined as the nonlinear response of the plasma to external boundary conditions. Neither existence nor uniqueness of solution is guaranteed for this nonlinear elliptic free-boundary problem. In this paper we discuss algorithms which we have developed to obtain particular numerical solutions to the MHD equilibrium problem. These algorithms have been divided into two categories, those involving current initialization and those involving feedback stabilization.

34059 **(GA-A—16418) Current driven nonideal instability in a force-free toroidal plasma.** Chu, M.S.; Helton, F.J.; Lee, J.K.; Moore, R.W.; Greene, J.M.; Jensen, T.H. (General Atomic Co., San Diego, CA (USA); Princeton Univ., NJ (USA)). Jul 1981. Contract AT03-76ET51011. 27p. (CONF-810947—2). NTIS, PC A03/MF A01. Order Number DE81029892.

From European workshop on the behavior of magnetically-confined plasmas; Wildhaus, Switzerland (9 Sep 1981).

The problem of the current-driven linear instability of a general force-free equilibrium has been formulated in terms of a variational problem with the vector potential as the trial function. The formalism allows A Vector . B Vector$_0$ not equal to 0 so that nonideal effects are modeled. The variational problem has been studied numerically for both infinite aspect ratio and finite aspect ratio tokamaks. Results of these numerical studies are presented.

34060 **(GA-A—16441) GATO: an MHD stability code for axisymmetric plasmas with internal separatrices.** Bernard, L.C.; Helton, F.J.; Moore, R.W. (General Atomic Co., San Diego, CA (USA)). Jul 1981. Contract AT03-76ET51011. 19p. (CONF-810947—1). NTIS, PC A02/MF A01. Order Number DE81029889.

From European workshop on the behavior of magnetically-confined plasmas; Wildhaus, Switzerland (9 Sep 1981).

The GATO code computes the growth rate of ideal magnetohydrodynamic instabilities in axisymmetric geometries with internal separatrices such as doublet and expanded spheromak. The basic method, which uses a variational principle and a Galerkin procedure to obtain a matrix eigenvalue problem, is common to the

ERATO and PEST codes. A new coordinate system has been developed to handle the internal separatrix. Efficient algorithms have been developed to solve the matrix eigenvalue problem for matrices of rank as large as 40,000. Further improvement is expected using graph theoretical techniques to reorder the matrices. Using judicious mesh repartition, the marginal point can be determined with great precision. The code has been extensively used to optimize doublet and general tokamak plasmas.

**34061 (KMSF-U—1109) Laser heated gas-jet: a soft x-ray source.** Charatis, G.; Slater, D.C.; Mayer, F.J.; Tarvin, J.A.; Busch, G.E.; Sullivan, D.; Musinski, D.; Matthews, D.L.; Koppel, L. (KMS Fusion, Inc., Ann Arbor, MI (USA); Lawrence Livermore National Lab., CA (USA)). 1981. Contract AC08-78DP40030. 6p. (CONF-810651—7). NTIS, PC A02/MF A01. Order Number DE81029627.

From 1981 topical conference on low-energy X-ray diagnostics; Livermore, CA, USA (8 Jun 1981).

The laser irradiated gas jet developed to study collective scattering processes has proven to be a useful soft x-ray source. It is a reproducible and stationary source with large yield and plasma properties characterized by conventional diagnostic techniques. With a density gradient initially set by orifice size and gas pressure, a short ($\sim$ 100 to 1000 psec) pulse operating at 1.05 $\mu$m (or 0.53 $\mu$m) is focused coaxially upstream into the jet producing a moderate temperature plasma. X-ray pinhole photographs show an axially symmetric radiating plume located at the electron density critical surface. The density gradient is obtained by holographic interferometry using a 0.26 $\mu$m wavelength probe pulse. The scale length of $\sim$ 100 to 200 $\mu$m is measured by $2\omega$ and $3/2\omega$ photography. Electron temperatures are determined by using spatially resolving x-ray crystal spectroscopy to record and analyze line emission from H- and He-like configurations. Electron temperatures from $\sim$ 200 to 700 eV were observed at critical electron densities as high as N/sub cr/ $\sim 4 \times 10^{21}$ cm$^{-3}$ for gases of hydrogen, nitrogen, neon, argon, and $SF_6$.

**34062 (LA-UR—81-2572) Ultra-high-density plasma experiments: MHD simulations.** Brownell, J.H.; Lindemuth, I.R.; Oliphant, T.A.; Weiss, D.L. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 6p. (CONF-810906—8). NTIS, PC A02/MF A01. Order Number DE81030244.

From 10. European conference on controlled fusion and plasma physics; Moscow, USSR (14 Sep 1981).

High density, laser-initiated, gas-embedded Z-pinch experiments which are being performed at Los Alamos are being treated computationally using a two-dimensional magnetohydrodynamic computer code. All aspects of the experiment are modeled including the laser-optics system, the Marx-bank/transmission line, electron avalanching, and the experimental diagnostics. Experimental observations have been reproduced very well. The plasma produced in the experiments has n/sub e/$> 10^{20}$/cm$^3$, T=200eV, and n/sub e/tau $> 2 \times 10^{13}$ s/cm$^3$.

**34063 (ORNL/CSD/TM—157) Comparison of results between the ballooning-modes codes BLOON and BALOON.** Munro, J.K. Jr. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 35p. NTIS, PC A03/MF A01. Order Number DE81030259.

Ballooning mode equation eigenvalues calculated by two different codes, BLOON (written at General Atomic) and BALOON (written at Oak Ridge National Laboratory) have been compared for a sequence of equilibria having a range of $\beta$ values. The results agree for marginal stability only. Differences away from marginal stability may be due to differences in the coordinate systems used for the analysis in the two codes. Equilibria were generated using the ISLAND code of D. Stevens of New York University. Results of various convergence studies made with the codes are presented together with recommendations for their use.

**34064 (ORNL/TM—7001) Simple-power-balance model for microwave heating in EBT.** Batchelor, D.B. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 65p. NTIS, PC A04/MF A01. Order Number DE81030428.

A simple model is presented for the production and absorption of ordinary and extraordinary mode energy in various regions of the ELMO Bumpy Torus plasma. The plasma is divided into two regions: (I) the low magnetic field side of the extraordinary mode cutoff and (II) the high field side of the cutoff. Energy balance equations are written for the sources (injection, mode conversion, and tunneling) and sinks (mode conversion, absorption, and tunneling) in each region, and simplified models are introduced to account for each of these processes. Since a typical ray makes several reflections from cavity wall surfaces before being absorbed, additional simplifying assumptions are made that the wave fields are an isotropic incoherent superposition of plane waves and that the energy density of each mode is uniform in a given region.

**34065 (ORNL/TM—7857) Beta limits in EBT and their implications for a reactor.** Uckan, N.A.; Spong, D.A.; Nelson, D.B. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 23p. (CONF-810680—3). NTIS, PC A02/MF A01. Order Number DE81030427.

From Symposium on physics problems of fusion reactors; Trieste, Italy (2 Jun 1981).

Because of uncertainties in extrapolating results of simplified models to a reactor plasma, the parameters that influence the beta limits cannot be determined accurately at the present time. Also, reasonable changes within the models and/or assumptions are seen to affect the core beta limits by almost an order of magnitude. Hence, at the present, these limits cannot be used as rigid (and reliable) requirement for ELMO Bumpy Torus (EBT) reactor engineering considerations. However, sensitivity studies can be carried out to determine the boundaries of the operating regime and to demonstrate the effects of various modes, assumptions, and models on reactor performance (Q value). First the modes believed to limit the core $\beta$ and ring plasma performance are discussed, and the simplifications and/or assumptions involved in deriving these limits are highlighted. Then, the implications of these limits for a reactor are given.

**34066 (PPPL—1814) Stabilizing windings for the tilting and shifting modes in an inductively formed spheromak.** Jardin, S.C.; Christensen, U. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1981. Contract AC02-76CH03073. 8p. NTIS, PC A02/MF A01. Order Number DE81030383.

It is shown that a set of 4 passive conducting coils, each with the figure 8 topology, will stabilize a spheromak to the rigid body toroidal mode number n = 1 tilting and shifting modes. The inclusion of these coils does not interfere with the inductive formation process.

**34067 (PPPL—1829) Helical equilibrium.** Yoshikawa, S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1981. Contract AC02-76CH03073. 22p. NTIS, PC A02/MF A01. Order Number DE81030384.

A straight, helical plasma equilibrium equation is solved numerically for a plasma with a helical magnetic axis. As is expected, by a suitable choice of the plasma boundary, the vacuum configuration is made line $\int$ dl/B stable. As the plasma pressure increases, the line $\int$ dl/B criterion will improve (again as expected). There is apparently no limit on the plasma $\beta$ from the equilibrium consideration. Thus helical-axis stellarator $\beta$ will presumably be limited by MHD stability $\beta$, and not by equilibrium $\beta$.

**34068 (PPPL—1830) Electromagnetic kinetic toroidal eigenmodes for general MHD equilibria.** Rewoldt, G.; Tang, W.M.; Chance, M.S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1981. Contract AC02-76CH03073. 50p. NTIS, PC A03/MF A01. Order Number DE81030385.

A comprehensive analysis of low-frequency, high-toroidal-mode-number linear eigenmodes for tokamaks is presented. The most significant new features of this stability study are that the calculation is interfaced with a general numerical magnetohydrodynamic (MHD) equilibrium, and that it is fully electromagnetic. The ballooning formalism is employed and all important kinetic effects, including those of trapped particles, are retained. In particular, the familiar trapped-electron-drift-wave frequency regime is considered and results are presented for three se-

quences of artificial equilibria: one of increasing $\beta$ (identical with plasma pressure/magnetic pressure) values; one of varying equilibrium shape, from inverse-D to circular to normal-D; and one of increasing vertical ellipticity. The analysis is then applied to a realistic (self-consistent) high-$\beta$ equilibrium generated with data obtained from the ISX-B tokamak experiment. Here it is found that, for the usual trapped-electron branch, kinetic microinstabilities appear to be present over a wide range of toroidal mode numbers.

34069 **(PPPL—1831) Axisymmetric stability of vertically asymmetric tokamaks at large beta poloidal.** Yamazaki, K.; Fishman, H.; Okabayashi, M.; Todd, A.M.M. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Grumman Aerospace Corp., Princeton, NJ (USA)). Sep 1981. Contract AC02-76CH03073. 26p. NTIS, PC A03/MF A01. Order Number DE81030382.

The stability of high-$\beta$ vertically asymmetric tokamak equilibria to rigid displacements is investigated analytically. It is found that vertical stability at large beta poloidal is mainly determined by a coupling between the shape of the plasma surface and the Shafranov shift of the magnetic axis. To the lowest order, symmetric components of the plasma surface shape are found to be the critical destabilizing elements. Asymmetric components have little effect. The inclusion of higher order terms in the high $\beta$ tokamak expansion leads to further destabilization. Qualitative agreement between these analytic results and numerical stability calculations using the PEST code is demonstrated.

34070 **(SAI—254-81-262-LJ) Tandem transport and ambipolarity in the resonant plateau regime.** Myra, J.R.; Catto, P.J. (Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.). Aug 1981. Contract AC03-76ET53057. 10p. NTIS, PC A02/MF A01. Order Number DE81030224.

A simple model for ion radial transport in the resonant plateau regime is derived. It is shown that the ion loss rate is insensitive to the radial electric field over a wide range of parameters. Using this result, and the expression for the electron flux, a self-consistent picture of ambipolar tandem operation for quadrupole symmetric systems is obtained and compared with experiment.

34071 **(UCID—19173) Using spectral line profiles as a diagnostic of the plasma electron density.** Lee, R.W.; Matthews, D.L. (Lawrence Livermore National Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 22p. NTIS, PC A02/MF A01. Order Number DE81030313.

A description of a simple interactive fitting procedure is given which uses line profiles calculated for highly stripped ions, i.e., hydrogenic, helium-like and lithium-like species. Information on the calculation of these profiles is provided. The experimental data is read from disk, so any appropriately formatted data can be referenced.

34072 **(UCRL—86162) Design of neutron streak camera for fusion diagnostics.** Wang, C.L.; Kalibjian, R.; Singh, M.S. (Lawrence Livermore National Lab., CA (USA)). 16 Jun 1981. Contract W-7405-ENG-48. 5p. (CONF-810906—6). NTIS, PC A02/MF A01. Order Number DE81029866.

From 10. European conference on controlled fusion and plasma physics; Moscow, USSR (14 Sep 1981).

In laser fusion, such as with the NOVA under construction at the Lawrence Livermore National Laboratory, the D-T reaction is expected to be complete within 100 ps. It is important to measure the time-dependence of the neutron flux from the fusion target. We describe the design of a new neutron detector of 20 ps resolving time that can be used to study the history of fusion burn.

34073 **(UCRL—86163) Hyper-filter-fluorescer spectrometer for fusion x-ray diagnostics.** Wang, C.L. (Lawrence Livermore National Lab., CA (USA)). 16 Jun 1981. Contract W-7405-ENG-48. 6p. (CONF-810906—7). NTIS, PC A02/MF A01. Order Number DE81029867.

From 10. European conference on controlled fusion and plasma physics; Moscow, USSR (14 Sep 1981).

The filter-fluorescer spectrometer (FFS) is a powerful tool for measuring x-ray spectrum from high fluence x-ray sources. However, this technique is limited to energies less than 120 keV, because there are no practical absorption edges available above this energy. In this paper, we present a new method of utilizing the filter-fluorescer system for x-ray spectral measurement above 120 keV. The new apparatus is called hyper-filter-fluorescer spectrometer (HFFS).

34074 **Techniques for measuring the alpha-particle distribution in magnetically confined plasmas.** Post, D.E. (Princeton Univ., NJ); Mikkelsen, D.R.; Hulse, R.A.; Stewart, L.D.; Weisheit, J.C. Contract EY-76-C-02-3073. *Journal of Fusion Energy ;* **1**: No. 2, 129-142(Apr 1981).

Methods are proposed for measuring the alpha-particle distribution in magnetically confined fusion plasmas using neutral-atom doping beams, ultraviolet spectroscopy, and neutral particle detectors. In the first method, single charge exchange reactions, $A^0 + He^{2+} \rightarrow A^+ + (He^+)^*$, are used to populate the $n = 2$ and $n = 3$ levels of $He^+$. The ultraviolet photons from the decaying excited states are Doppler shifted by 5 to 10 A from those produced by the thermalized alpha-particle ash. In the second method, double charge exchange reactions, $A^0 + He^{2+} \rightarrow A^{2+} + He^0$, enable fast neutralized alpha particles to escape from the plasma and be detected by neutral particle analyzers. These methods are distinguished from similar techniques of observing plasma impurities in that, in principle, they allow a determination of the dependence of the distribution function on energy and pitch angle, as well as on spatial position. Detector configurations are analyzed, count rates are estimated, and the detector feasibility is discussed. A preliminary analysis of the feasibility of the required neutral beams is presented, and exploratory experiments on existing devices are suggested.

## 7002 Fusion Power Plant Technology

*REFER ALSO TO CITATION(S) 33498, 33502, 33515, 33517, 33522, 33526, 33532, 33537, 33567, 33633, 33640, 33648, 33649, 34072*

34075 **(CONF-801011—(Vol.1)) Technology of controlled nuclear fusion.** Tenney, F.H.; Hopkins, C.C. (eds.). (Department of Energy, Washington, DC (USA)). Jul 1981. 280p. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Separate abstracts were prepared for 29 of the included papers. Abstracts for the remaining papers appeared previously in ERA. (MOW)

34076 (CONF-801011—(Vol.1), pp 29-39) **Fusion technology program in Japan.** Mori, S. (Japan Atomic Energy Research Inst., Tokyo). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A fusion reactor development program in Japan is an ongoing national project, which is advancing as planned. Major near-term objectives are to demonstrate reactor grade plasmas in tokamak confinement and to develop a system of fusion reactor engineering with a focus on the next step after the demonstration in a large tokamak, JT-60.

34077 (CONF-801011—(Vol.1), pp 40-46) **INTOR workshop.** Stacey, W.M. Jr. (Georgia Inst. of Tech., Atlanta). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

An intensive, international effort to define objectives and characteristics of the next major tokamak experiment and to assess its technical feasibility was completed in 1979. A preconceptual design is presently in progress.

34078 (CONF-801011—(Vol.1), pp 52-59) **Status of tokamak confinement experiments.** Davies, N.A. (Dept. of Energy, Washington, DC). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Among magnetic fusion concepts, the tokamak is the most advanced in terms of understanding and parameters achieved relative to reactor requirements. A schematic of the tokamak configuration is shown. The major areas of tokamak research are confinement, heating, beta limits, disruption control, particle control, and current drive. This paper will describe the latest results in each of these areas.

34079 (CONF-801011—(Vol.1), pp 67-80) **Fueling and exhaust: an engineering view.** Montgomery, D.B. (Massachusetts Inst. of Tech., Cambridge); Yang, T.F.; Milora, S.L. Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

An engineering view of fueling and exhaust from the present vantage point is a mixed one. The view of fueling appears clearer than that of exhaust. Exploratory studies of fueling by pellet injection in present day devices such as ORMAK, ISX and PDX have proven very successful. Pellet size must yet be increased by a factor of approximately 5, but currently achieved injection velocities of 1000 m/sec may be sufficient if shallow penetration fueling is acceptable in the reactor plasma regime. High repetition rate injectors must still be developed, and tritium pellets produced, but both appear feasible. The engineering view of exhaust is less straight-forward. Exhausting by divertors leads to machine complication and major heat and erosion problems on the generally limited area targets. Exhausting by neutralizing and pumping at in-chamber limiters appears to reduce complexity, but is also faced with severe heat and erosion problems. The in-chamber concepts also lack the divertor chamber's isolation, and are therefore less adaptable to concepts which might mitigate erosion.

34080 (CONF-801011—(Vol.1), pp 154-159) **Burn stabilization of an ignited tokamak in a static or pseudostatic vertical field.** Borrass, K. (Max-Planck-Institut fuer Plasmaphysik, Garching, Germany). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Burn stabilization of an ignited tokamak by a static or pseudostatic vertical field is considered, emphasis being placed on application to a ZEPHYR-like system. A pseudostatic field is a feedback-controlled, time-dependent vertical field which is equivalent to a static one but with arbitrary field index. A time-dependent, fully nonlinear 0-D model is used to study the system's response to finite perturbations. Relevant performance indices, subjected to constraints in practice, are discussed to determine the range of good stability behavior. The results are related to linear and 1-D considerations. Nonlinear effects are found to play a significant role. For typical field indices static self-stabilization fails. Stabilization by a pseudostatic field, however, is found to be an attractive scheme for the system under consideration.

34081 (CONF-801011—(Vol.1), pp 207-224) **Analysis by hybrid computer simulation of a power level control system for a tokamak fusion reactor plasma.** Lipner, M.H.; Impink, A.J. Jr.; Heck, F.M. (Westinghouse Electric Corp., Pittsburgh, PA). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A hybrid computer simulation of the dynamic characteristics of a tokamak-type plasma and appropriate control systems has been developed. In this simulation alternative assumed physical characteristics of the plasma were represented by flexible, self-consistent models. The variations in assumed plasma physical characteristics included the mode of particle confinement, the dependence of plasma dimension on plasma temperature, the energy of ion injection and the relation between particle and energy confinement. The major result of the study was the demonstration that the plasma power level can be controlled effectively under both normal and projected abnormal plant operating conditions. Secondly, it was shown that there exists at least one general plasma power level control strategy that is not strongly dependent on details of the physical processes that are expected to occur within the plasma.

34082 (CONF-801011—(Vol.1), pp 225-228) **Reactor aspects of expanded boundary approach.** Ohyabu, N. (General Atomic Co., San Diego, CA). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

In the expanded boundary approach, heat flux from a plasma core is converted into radiative power in the expanded boundary. The radiative cooling power is enhanced by the effect of the plasma flow as well as by a volumetric factor and the resultant edge cooling ameliorates serious technological difficulties in tokamak reactors such as heat load and erosion problems. Furthermore, the required coil system appears to be simple.

34083 (CONF-801011—(Vol.1), pp 229-236) **Thermal and structural analyses of a long pulse multiaperture grid for a neutral beam injector.** Ruester, D.E.; Bowers, D.A. (McDonnell Douglas Astronautics Co., St. Louis, MO). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

This paper summarizes the analysis used in designing a multiaperture grid assembly with a 13 cm x 43 cm perforated region for a 120 keV, 60 ampere ion accelerator. The grid assembly consists of four commercially pure molybdenum water cooled grids. Major emphasis was placed on maximizing grid transparency while maintaining deflections within acceptable limits. Transparency is the ratio of total area of apertures (holes) divided by total grid area. Thermal analysis was conducted to determine the effects of coolant flow rates and variable thermal conductance around the apertures in the plane of the grid. Temperatures were calculated over the face of each grid so that deflections and stresses could be calculated. Finite element models were used to calculate the effective modulus of elasticity and effective Poisson's ratio of the perforated grids.

34084 (CONF-801011—(Vol.1), pp 237-245) **Technology issues of tract plasma engineering.** Steinhauer, L.C.; Willenberg, H.J. (Mathematical Sciences Northwest, Inc., Bellevue, WA). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The Triggered-Reconnection Axially Compressed Torus (TRACT) concept resembles a reversed-field theta pinch except that an important part of the plasma heating is accomplished by strong axial shock waves. This unique heating method is made possible by (1) a special magnetic configuration which permits the trapping of a large amount of reversed magnetic flux, and (2) the delayed reconnection of the reversed field lines. The reactor manifestation also employs a compound magnet, i.e., the combination of a steady superconducting solenoid and pulsed normal coils. The technological implications of this method of fusion plasma formation and heating are examined. Particular issues addressed include the electric field at the wall required to drive the radial implosion, the size of the capacitor bank, and the achievable plasma dimensions (and related implications, especially, nonuniform wall loading).

34085 (CONF-801011—(Vol.1), pp 261-269) **Structural dynamics of toroidal field coil in magentic fusion reactor.** Miya, K.; Uesaka, M.; An, S. (Univ. of Tokyo, Japan). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Numerical analysis of a harmonic vibration of toroidal field coils in a full torus is presented. Frequency of the harmonic vibration for supplied current is given as a solution of a Lagrange's equation by using the finite element method. It is confirmed from the numerical results that the structural dynamics of toroidal field coils is closely associated with the buckling phenomenon.

34086 (CONF-801011—(Vol.1), pp 269-282) **General Electric's large superconducting magnet design and development for fusion applications.** Ferrante, J.J.; Heinrich, J.P.; Quay, R. (General Electric Co., Schenectady, NY). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The oval-shaped 7 x 11 m bore coils designed by the GE/Intermagnetics General Corporation team for the Experimental Power Reactor study used a copper stabilizer NbTi pool boiling conductor with distributed stainless steel reinforcement for the 8 T tokamak, and forced flow $Nb_3Sn$ conductor for the 12 T applications. Modular, continuous, and hybrid dewars were evaluated and recommendations made for the 2.35 x 3.35 bore size, 8 T, test coils for the Large Coil Program. The NbTi pancake wound conductor for this test coil is enclosed by a 316 LN stainless steel welded plate fabrication which is bolted at final assembly around the fully instrumented winding. A 12 T $Nb_3Sn$ pool boiling conductor design for an Engineering Test Facility size toroidal field coil has been incorporated into a 1 m diameter model coil. A GE team at ORNL is extending these applications for the ETF magnetic system coil applications. A study of the magnetic system for the Elmo Bumpy Torus-Proof of Principle has shown that epoxy-impregnated mirror coils can meet the performance requirements in a cost effective manner.

34087 (CONF-801011—(Vol.1), pp 283-292) **Engineering and producing the General Dynamics/IGC magnet for the Large Coil Program.** Hackley, D.S. (General Dynamics Convair Division, San Diego, CA); Kruse, G.S.; Johnson, T.E.; Ring, D.S.; Scudiere, J.D. Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A crucial milestone in the nation's controlled nuclear fusion program is the need to demonstrate the manufacturability and workability of large toroidal field superconducting magnets for tokamak reactors. As part of this goal, the General Dynamics-Intermagnetics General Corporation team is currently fabricating a 2.4 m x 3.4 m bore size 8-Tesla superconducting toroidal field coil for inclusion in Oak Ridge National Laboratory's (ORNL) Large Coil Program (LCP) test facility. Engineering this coil to enhance manufacturability and inspectability has been an important part of our participation in this project since its inception. We have progressed through the fabrication phase of LCP to the point where coil winding is imiminent. Based on our manufacturing experience to date, this paper presents our contribution to moving large superconducting magnet technology into production hardware.

34088 (CONF-801011—(Vol.1), pp 329-334) **Analysis of the dynamic behavior of the electric arc for fusion magnet safety.** Schneider, H.; Caretta, A. (CEC Joint Research Centre, Ispra, Italy). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The arcing process in magnet subsystems constitutes a main safety concern for controlled nuclear fusion reactors. A theoretical model for the estimation of the time dependent arc-current and -voltage has been set up and based on a proper circuit equation, and on the AYRTON formula for the current-voltage characteristic of the arc. The model is applied to the case of arcing between turns in the toroidal magnet system of the conceptual design of FINTOR, a minimum size Tokamak DT experimental reactor.

34089 (CONF-801011—(Vol.1), pp 350-359) **Superconducting toroidal field coil system for STARFIRE.** Alcorn, J.S. (General Atomic Co., San Diego, CA); Turner, L.R.; Wang, S.T. Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The 12 element toroidal field coil array has a characteristic envelope radius of about 14 meters, within which is contained 50 GJ of stored magnetic energy. The basic design is based upon employment of 4 K helium bath cooled $Nb_3Sn$ superconductor for the high field region, NbTi being utilized from 9 tesla down. The option of employing NbTi alloy throughout, bath cooled at 3.5 K saturation temperature, is also presented. A 24 kA, three level, unsoldered Rutherford cable design has been selected for the conductor: four field graded regions are employed to minimize coil thickness. Minimum copper current densities are set by stability considerations in the high field region and by coil production considerations at low field. All significant conductor hoop and bearing loads are borne by a stainless steel frame structure which surrounds, and is interwound with, the conductor. The coils are pancake wound within an austenitic stainless steel helium vessel. Partial height flanking layers are employed to maximize space utilization in the critical centerpost region.

34090 (CONF-801011—(Vol.1), pp 387-394) **Neutron spectra and tritium production rate measurements in the one dimensional LiF slab geometry as a fusion reactor blanket benchmark experiment.** Iguchi, T.; Nishitani, T.; Takagi, J.; Nakazawa, M.; Sekiguchi, A. (Univ. of Tokyo, Japan). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Neutronic benckmark experiments have been presented on the Lithium Fluoride (LiF) slab assembly with 14 MeV mock plane neutron sources performed at the CTR Blanket Engineering Research Facility of the University of Tokyo. Main features of this experiment are one dimensional geometry and LiF-Thermoluminescent dosimetry (LiF-TLD) which shows a similar response to the tritium production-rate and/or heating-rate in the LiF material. Another feature is neutron spectrometry using time-of-flight and/or counter techniques and additional experiments using fission-like neutron source have been carried out to validate the 14 MeV neutron experiment. These data have been compared with the one-dimensional transport code, ANISN in current use for neutronic design.

34091 (CONF-801011—(Vol.1), pp 395-404) **Review of integral fusion blanket neutronic experiments.** Green, L. (Westinghouse Electric Corp., Pittsburgh, PA). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A review is presented of integral fusion blanket neutronics experiments that have been reported since 1976. Most of the work is a continuation of earlier studies; the JAERI fission rate profiles, and the Livermore pulsed sphere leakage spectrum measurements. Several tritium production studies in homogeneous spheres and cylinders are also described. The integral experiments have been valuable in identifying cross section deficiencies and in demonstrating the importance of preequilibrium neutron emission to the transport of 14 MeV neutrons. The review concludes with brief discussions of future directions in integral blanket experiments, and on the developmental needs for the support of such programs.

34092 (CONF-801011—(Vol.1), pp 411-418) **Developments in blanket neutronics for CTR's.** Beynon, T.D. (Univ. of Birmingham, England). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Current concern with the effects on tritium breeding of uncertainties in $^7Li$ and natural lead cross section data is examined. Integral and differential measurements give strong indications that the $^7Li(n,n')\alpha T$ cross section may be as much as 15 to 25% lower than the evaluations in ENDF/B and UKNDL and the effect of such uncertainties is evaluated in terms of some current breeder blanket designs. A summary of the proposed neutron diagnostic system for JET is presented.

34093 (CONF-801011—(Vol.1), pp 430-438) **Blanket and shield nucleonic considerations for the Field-Reversed Mirror Small Reactor.** Cheng, E.T. (General Atomic Co., San Diego, CA). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A blanket and shield nucleonics design study employing the reflector-shield concept is completed for the Field-Reversed Mirror Small Fusion Reactor (FRMSFR). The reflector-shield concept bears many advantages for the magnetically confined fusion reactors. It minimizes the total blanket and shield thickness, and enhances the tritium breeding and blanket energy multiplication. For the FRMSFR blanket and shield system, which consists of Inconel 718 first wall and structure, $Li_2O$ breeding material, and 316 SS-$B_4C$ shield, a tritium breeding ratio of 1.13 is attained, which is adequate for self-refueling. The blanket energy multiplication is 1.21. The radiation damage parameters such as atomic displacement in the copper stabilizer, neutron fluence at the superconductors, nuclear heat dose to the insulation materials, and nuclear heating to be removed, calculated using the one-dimensional cylinder blanket model, are below the respective design limit when a shield combination of 0.5 m 316 SS and 0.3 m $B_4C$, and a total blanket and shield thickness of 1.18 m are employed. However, the calculated radiation damage results using the two-dimensional model are more than one order of magnitude lower than the one-dimensional model despite the fact that the overall tritium breeding ratio and the total nuclear heating agree very well for both models. This indicates that the one-dimensional cylinder model cannot realistically approximate the locally extended fusion plasma for the FRMSFR.

34094 (CONF-801011—(Vol.1), pp 458-463) **Importance of shield design in minimizing radioactive material inventory in tokamaks.** Jung, J.; Abdou, M. (Argonne National Lab., IL). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

An optimization study is carried out for the outboard bulk shielding of the STARFIRE reactor. The optimization criteria used include: (1) reactor accessibility shortly after shutdown; (2) minimization of high-level long-term induced activation; and (3) radiation protection of reactor components. It is shown that with a 1.1 m-thick shield, the biological dose inside the reactor room decreases to $\sim$ 1.5 mrem/h within 24 h after shutdown. It is also shown that more than 90% of the total mass of the radioactive material inventory in STARFIRE has a high potential for recycling within 30 to 50 y after component replacement or reactor decommissioning.

34095 (CONF-801011—(Vol.1), pp 464-469) **Activation of containment atmospheres in DT fusion facilities.** Leonard, B.R. Jr. (Battelle Pacific Northwest Labs., Richland, WA); Perry, R.T. Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The production of radionuclides by neutron reactions in the building air of a conceptual Tokamak Engineering Test Facility has been calculated. The short-lived radionuclides $^{13}N$, $^{16}N$ and $^{41}Ar$ are all found to greatly exceed their maximum permissible concentration values. Longer-lived radionuclides $^{3}H$, $^{14}C$, and $^{39}Ar$ are also found to be produced in significant concentrations. The present results are compared with values calculated for three other fusion devices; TFTR, INS, and FMIT. These comparisons show that the ETF is the most prolific producer of activated air and that the $^{41}Ar$ production for TFTR and FMIT may have been significantly underestimated.

34096 (CONF-801011—(Vol.1), pp 470-472) **Review of neutronic design criteria.** Perry, R.T.; Maynard, C.W. (Univ. of Wisconsin, Madison). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The neutronic design criteria for fusion reactors is reviewed. It was found that some values for criteria are poorly fixed. For example, the tritium breeding ratio has often been set unrealistically high with no provisions for adjusting values. It was also found that although energy production is the primary reason for a reactor's existence, little effort has been made to maximize it by blanket energy multiplication. Lastly, further optimization studies could result in thinner shields.

34097 (CONF-801011—(Vol.1), pp 498-501) **Low permeability materials for tritium and tritium removal with organic materials.** Alire, R.M.; Souers, P.C.; Miller, H.H.; Steward, S.A. (Lawrence Livermore National Lab., CA). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Tritium permeates all materials, driven by a concentration gradient across the material. Finding materials with low tritium permeability is our goal. To this end, we are measuring tritium permeability through materials with potentially low permeability. We are testing materials at 20 to 200°C and $\leqq$ 1 atm, conditions we expect for tritium processing in fusion reactors. Aluminum is our first choice because it has a low hydrogen permeability. Our evidence indicates that the water adsorbed on the surface of the air-oxidized layer controls the absorption and desorption. It is not clear that we can derive bulk diffusion constants or solubility from absorption and desorption measurements.

34098 (CONF-801011—(Vol.1), pp 502-508) **Recent tritium handling experiments at the University of Tokyo.** Tanaka, S.; Ono, F.; Nakazawa, M.; Takahashi, Y.; Kiyose, R.; Kanno, M. (Univ. of Tokyo, Japan). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Recent studies performed at the CTR Blanket Engineering Research Facility of the University of Tokyo are presented. These studies include: (1) Catalytic oxidation of tritium. The oxidation of hydrogen containing tritium catalyzed by copper oxide and palladium has been investigated with particular interests on isotopic swamping; (2) Distribution equilibrium of tritium between adsorbed water on molecular sieve and environmental water. The equilibrium partition coefficient of tritium has been determined to be 1.1 to 1.4 for tritium concentration 0.01 to 100 $\mu$Ci/ml at 5 to 45°C; (3) Isotopic separation of T and D by sorption in the KC/sub x/ lamellar compounds. The separation factors for $HT/H_2$ and $D_2/H_2$ by the sorption in the equilibrium in KC/sub x/ have been found to be 4.8 and 10.2, respectively, which are remarkably high as compared with other processes.

34099 (CONF-801011—(Vol.1), pp 535-542) **Cost of generating tritium internal and external to a tokamak hybrid reactor.** Crotzer, M.E. (Westinghouse Electric Corp., Pittsburgh, PA); Heck, F.M.; Steinke, K.C. Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The costs associated with producing tritium internal and external to a thorium-based tokamak hybrid are estimated for a number of scenarios and the resulting impact on the symbiotic system cost of electricity calculated. For tritium generation within the hybrid, both continuous and batch production is analyzed. For external production, the lithium-bearing blanket is replaced with thorium and the tritium is generated in the client fission reactors. Continuous tritium production within the hybrid is found to increase the cost of electricity from 1.4 to 4.0 mills/kW-h. Batch tritium production can increase the cost of electricity by 10 mills/kW-h. Producing tritium outside the hybrid, and thereby enhancing client support, increases the cost of electricity from 1.8 to 4.1 mills/kW-h.

34100 (CONF-801011—(Vol.1), pp 555-559) **Catalytic oxidation efficiencies for tritium and tritiated methane in a mature, industrial-scale decontamination system.** Mintz, J.M.; Gildea, P.D. (Sandia National Labs., Livermore, CA). Jul 1981. NTIS, PC A13/MF A01. Order Number DE81027359.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Almost all tritium decontamination systems proposed for fusion facilities employ catalytic oxidation to water, followed by drying, to remove tritium and tritiated hydrocarbons from gas streams. One such large-scale system, the gas purification system (GPS), has been operating in the Tritium Research Laboratory (TRL) at Sandia National Laboratories, Livermore, CA, since October 1977. A series of experiments have recently been conducted

there to assesss the current operating characteristics of the GPS catalyst. The experiments used tritium and tritiated methane and covered a range of temperatures, flow rates, and concentration levels. When contrasted with 1977 data, the results indicate that no measurable degradation of catalyst function had occurred. However, some reduction in active metal surface area, as indicated by B.E.T. surface area measurements ($\sim 100 \rightarrow 90 m^2/g$) and AES scans ($\sim 1.4 \rightarrow 0.9$ at. % Pt), had occurred. Kinetic rate coefficients were also derived and a rough temperature dependence obtained.

34101 **(CONF-801011—(Vol.2)) Technology of controlled nuclear fusion.** Tenney, F.H.; Hopkins, C.C. (eds.). (Department of Energy, Washington, DC (USA)). Jul 1981. 521p. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Separate abstracts were prepared for 38 of the included papers. Abstracts for the remaining papers appeared previously in ERA. (MOW)

34102 (CONF-801011—(Vol.2), pp 1224-1226) **Environmental and safety implications of alternate fuel fusion cycles.** Gordon, J.D. (TRW, Redondo Beach, CA); Steele, W.G.; Cherdack, R.N. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Proton-based fuels offer the double advantage of elimination of the breeding blanket and reducing the neutron output by orders of magnitude below that for D-T. The low neutron flux allows great flexibility in materials and design options. Because of the potential advantages of the proton-based, neutron-lean fuels, we have emphasized them in this study. The most attractive proton-based fuel is the p-$^{11}$B fuel cycle. Burn kinetics calculations have shown that the fuel ignites against Bremsstrahlung losses at an ion temperature of 300 keV. This fuel will be addressed in the remainder of the paper.

34103 (CONF-801011—(Vol.2), pp 1227-1237) **Fusion-fission hybrids and the environment: resource requirements.** Abdel-Khalik, S.I. (Univ. of Wisconsin, Madison); Jansen, P.; Kessler, G.; Klumpp, P. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

An investigation has been conducted to examine the impact of fusion-fission hybrids on world nuclear future. The primary objectives of this investigation have been: (1) to determine whether hybrids can allow us to meet the projected nuclear component of the world energy demand within current estimates of uranium resources with or without fast breeders, and (2) to identify the preferred hybrid concept from a resource standpoint.

34104 (CONF-801011—(Vol.2), pp 1238-1247) **Activation product transport in helium cooled fusion systems.** Bickford, W.E. (Pacific Northwest Lab., Richland, WA). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The transport and deposition of neutron activation products in a helium cooled tokamak fusion power plant are investigated. A reference coolant loop is presented and source terms are identified. Transport modeling techniques developed for HTGRs are used to predict entrained inventories, deposition patterns, and resultant contact dose rates. Blanket design techniques which could be used to reduce radiation hazards near piping and steam generators are discussed.

34105 (CONF-801011—(Vol.2), pp 1265-1277) **Utility perspective on inertial confinement fusion electric power generating plants.** Endicott, R.D.; Jensen, B.K.; Guerra, C.R. (Public Service Electric and Gas Research Corp., Newark, NJ). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

This paper will describe the work on developing the utility guidelines, and the potential environmental and licensing issues which have been identified from the examination of the various parts of the ICF fusion plant design. Specifically, we will discuss the parameters making up the utility guidelines, the use of large volumes of liquid lithium, the tritium inventory and the pellet metal radioactive wastes. Additional issues that impact the acceptability of the power plant include classified facilities, and the use of natural resources. Also, the methodology will be described that is used by the utilities to make economic decisions and judgements between competing technologies.

34106 (CONF-801011—(Vol.2), pp 1278-1281) **TFTR safety approaches.** Levine, J.D. (Ebasco Services Inc., Princeton, NJ); Lind, K.E.; Howe, H.J. Jr. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Potential safety hazards associated with TFTR operations have been identified. A reliable system for assuring that future changes to TFTR facilities, systems and components will not compromise basic features provided to prevent and mitigate these hazards has been developed.

34107 (CONF-801011—(Vol.2), pp 1319-1335) **STARFIRE remote maintenance and reactor facility concept.** Graumann, D.W. (General Atomic Co., San Diego, CA); Field, R.E.; Lutz, G.R.; Trachsel, C.A. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A total remote maintenance facility has been designed for all equipment located within the reactor building and hot cell, although operational flexibility has been provided by design of the reactor shielding such that personnel access into the reactor building within 24 hours after reactor shutdown is possible. The reactor design permits removal and replacement of all components if necessary, however, the vacuum pumps, isolation valves and blanket require scheduled, routine maintenance. Reactor scheduled maintenance does not dominate annual plant downtime, therefore, several scheduled operations can be added without affecting reactor availability. The maintenance facilities consist of the reactor building, the hot cell, the reactor service area and the remote maintenance control room. The reactor building contains the reactor, selected support system modules, and required maintenance equipment. The reactor and the support systems are maintained with (1) equipment that is mounted on a monorail system; (2) overhead cranes; and (3) bridge-mounted electromechanical manipulators. The hot cell is located outside of the reactor building to localize contamination products and permit independent operation. An equipment air lock connects the reactor building to the hot cell.

34108 (CONF-801011—(Vol.2), pp 1342-1357) **Conceptual fusion power monitor based on the $^{16}O(n,p)^{16}N$ reaction.** Pettus, W.G. (Babcock and Wilcox Co., Lynchburg, VA). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The feasibility of developing a fusion power monitor based on a fluid activation detector is considered here. The activation fluid may be either a liquid or a gas and its composition can be selected from a number of candidate materials to provide desired activation and decay characterisitcs. Performance calculations indicate that ordinary water would be a nearly ideal activation fluid. The $^{16}O(n,p)^{16}N$ reaction has a threshold at about 10 MeV and a cross section energy dependence giving it a predominant response for unmoderated D-T fusion neutrons. Adequate activation can be obtained at moderate flow rates for remote counting away from the high radiation area of the reactor. The 7.16 sec half-life of $^{16}N$ is ideal for remote counting with subsequent decay in a small hold-up tank to eliminate activity build-up in the recycled water.

34109 (CONF-801011—(Vol.2), pp 1363-1369) **Tandem mirror and tokamak reactor maintainability comparison.** Zahn, H.S. (McDonnell Douglas Astronautics Co., St. Louis, MO). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The analysis proceeds through estimates of downtime and resources required for selected maintenance actions and optimization of the replacement fraction, availability and cost of electricity. Scheduled downtime estimates and availability goals provide a basis for determining allowable forced outage downtimes. These analyses have been conducted with the assumption of redundancy wherever feasible but without the impact of maintenance equipment outages. Annual maintenance cost estimates and availabilities for both reactors are found to be approximately equal. However, the tandem mirror reactor capital costs are higher. Reduction of these costs appears feasible with the trend of current design studies toward smaller and more accessible machines.

34110 (CONF-801011—(Vol.2), pp 1395-1398) **Heavy ion induction linacs for ICF.** Faltens, A. (Lawrence Berkeley Lab., CA); Hartwig, E.; Hoyer, E.; Keefe, D.; Laslett, L.J.; Smith, L.; Bangerter, R.; Mark, J. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

34111 (CONF-801011—(Vol.2), pp 1403-1408) **Drivers for light ion fusion.** VanDevender, J.P. (Sandia National Labs., Albuquerque, NM). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The light ion approach to inertial confinement fusion requires the production of $10^{13}$ to $10^{14}$ watt and $10^{6}$ to $10^{7}$ joule pulses. The accelerator technology developed in the particle beam fusion program is capable of fulfilling these requirements.

34112 (CONF-801011—(Vol.2), pp 1409-1416) **Fusion power plant laser driver system.** Babcock, R.V. (Westinghouse R and D Center, Pittsburgh, PA). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A modular $CO_2$ laser driver design has been developed for an ICF power plant. The performance and cost were modeled as a subroutine of an overall computer model which is being developed to compare the final electricity costs achievable from ICF Power plants using different driver technologies. The laser system satisfies point design requirements of delivering 2 MJ on target in 1 ns with a wall plug driver efficiency of about 10%, to an 1100 MWe power plant. The design is sufficiently modular and flexible to permit a rough optimization of performance and cost for other plant sizes, for updated estimates of pellet performance, and for updated tradeoffs in plant configuration.

34113 (CONF-801011—(Vol.2), pp 1417-1419) **Radio-frequency quadrupole linac in a heavy-ion fusion driver system.** Hansborough, L.D.; Stokes, R.H.; Swenson, D.A.; Wangler, T.P. (Los Alamos Scientific Lab., NM). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A new type of linear accelerator, the radio-frequency quadrupole (RFQ) linac, is being developed for the acceleration of low-velocity ions. The RFQ accelerator can be adapted to any ion species, and it is particularly suitable for high-current applications. A recent experimental test carried out at the Los Alamos Scientific Laboratory (LASL) has demonstrated the outstanding properties of RFQ systems. The test linac accepts a 30-mA proton beam of 100-keV energy and focuses, bunches, and accelerates the beam to an energy to 640 keV. This is done in a length of 1.1 m, with a transmission efficiency of 87% and with a radial emittance growth of less than 60%. The proven capability of the RFQ linac, when extended to heavy ion acceleration, should provide an ideal technique for use in the low-velocity portion of a heavy-ion linac for inertial-confinement fusion. A specific concept for such an RFQ-based system is described.

34114 (CONF-801011—(Vol.2), pp 1423-1433) **Fusion hybrid parametric studies to assess potential utility applications.** Rose, R.P. (Westinghouse Electric Corp., Pittsburgh, PA). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Parametric studies are described in which the effects of fusion driver choice and blanket/fuel cycle concept are examined. Results indicate that, from the standpoint of performance and cost, little difference can be attributed to the fusion driver selection among the magnetic and inertial confinement concepts considered. The principal differences are those due to the blanket/fuel cycle adopted. Incorporation of the hybrid in utility generation expansion scenarios shows a variety of cases in which favorable economics can be anticipated based on hybrid introduction at, or shortly after, the turn of the century.

34115 (CONF-801011—(Vol.2), pp 1434-1443) **Parametric systems analysis for ICF hybrid reactors.** Berwald, D.H. (TRW, Inc., Redondo Beach, CA); Maniscalco, J.A.; Chapin, D.L. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Parametric design and systems analysis for inertial confinement fusion-fission hybrids are presented. These results were generated as part of the Electric Power Research Institute (EPRI) sponsored Feasibility Assessment of Fusion-Fission Hybrids, using an Inertial Confinement Fusion (ICF) hybrid power plant design code developed in conjunction with the feasibility assessment. The SYMECON systems analysis code, developed by Westinghouse, was used to generate economic results for symbiotic electricity generation systems consisting of the hybrid and its client Light Water Reactors (LWRs). These results explore the entire fusion parameter space for uranium fast fission blanket hybrids, thorium fast fission blanket hybrids, and thorium suppressed fission blanket types are discussed, and system sensitivities to design uncertainties are explored.

34116 (CONF-801011—(Vol.2), pp 1444-1454) **Parametric systems analysis for tokamak hybrid reactors.** Chapin, D.L. (Westinghouse Electric Corp., Pittsburgh, PA). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A parametric systems analysis has been performed to evaluate the characteristics and economic potential of tokamak fusion-fission hybrid reactors. The results of the study indicate that there are many hybrid combinations that are feasible and have favorable economics, and as such could provide an assured supply of fissile fuel at a reasonable price. To perform the analyses, a tokamak reactor system sizing and costing computer code was used together with an economics code to calculate the cost of electricity and fissile fuel for the symbiotic system of the tokamak hybrid reactor and its supported client fission reactors. The studies covered a range in a number of key options for the hybrid operation, including the plasma performance, blanket composition, and fuel cycle. Three different blanket concepts covering a wide range in energy multiplication were considered - uranium fast fission, thorium fast fission, and thorium fission suppressed.

34117 (CONF-801011—(Vol.2), pp 1465-1474) **Fission suppressed tandem mirror hybrid reactor options.** Berwald, D.H. (TRW, Inc., Redondo Beach, CA); Maniscalco, J.A.; Lee, J.D.; Moir, R.W. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The design feasibility of several options for a fission suppressed tandem mirror hybrid reactor blanket are identified but are not ranked. These are based upon two or more radial zones incor-

porating a non-fission neutron multiplier zone and a fissile fuel ($^{233}U$) breeding zone. Neutron multiplier options include beryllium, lead, and liquid lithium. Fissile breeding options include thorium metal or oxide packed beds, molten thorium bearing salts, frozen thorium bearing salts, heavy water thorium slurries, and aqueous solutions containing dissolved thorium. Neutronic scoping results for a beryllium and a liquid lithium multiplier option are presented. These are compared with a reference design developed by Lawrence Livermore National Laboratory during 1979.

34118 (CONF-801011—(Vol.2), pp 1475-1486) **Utility market penetration assessment of fusion-fission hybrids.** Jensen, B.K.; Nour, N.E.; Piascik, T.M. (Public Service Electric and Gas Co., Newark, NJ). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The objective of this paper is to describe the utility generation expansion evaluation procedure and to present the results of a fusion-fission hybrid market penetration assessment in a model of a typical utility system. The analysis addresses the key factors and tradeoffs affecting the utility's evaluation of generation alternatives.

34119 (CONF-801011—(Vol.2), pp 1497-1504) **Study of DD versus DT fusion fuel cycles for different fusion-fission hybrid energy systems.** Gohar, Y.; Baker, C.C. (Argonne National Lab., IL). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A study was performed to investigate the characteristics of an energy system to produce fissile fuel for fission reactors. DD and DT fusion reactors were examined in this study with either a thorium or uranium blanket for each fusion reactor. Various fuel cycles were examined for light-water reactors including the denatured fuel cycles (which may offer proliferation resistance compared to other fuel cycles); these fuel cycles include a uranium fuel cycle with $^{239}Pu$ makeup, a thorium fuel cycle with $^{239}Pu$ makeup, a denatured uranium fuel cycle with $^{233}U$ makeup, and a denatured thorium fuel cycle with $^{233}U$ makeup. Four different blankets were considered for this study. The first two blankets have a tritium breeding capability for DT reactors. Lithium oxide ($Li_2O$) was used for tritium breeding due to its high lithium density and high temperature capability; however, the use of $Li_2O$ may result in higher tritium inventories compared to other solid breeders.

34120 (CONF-801011—(Vol.2), pp 1505-1517) **Suppressed fission blanket concepts for inertial confinement fusion.** Berwald, D.H. (TRW, Inc., Redondo Beach, CA); Whitley, R.H.; Massey, J.V.; Allen, W.O.; Blink, J.A.; McGrath, R.T. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A new inertial confinement fusion (ICF) hybrid reactor concept based upon the HYLIFE pure fusion reactor first wall protection concept has been developed. The features of a conceptual design based upon the HYLIFE hybrid concept are presented in this paper. These include consideration of the laser/target interaction, the cavity design, the suppressed fission blanket design, the hybrid and client LWR fuel cycles, the power plant concept, the plant cost, and a symbiotic economics analysis. Although additional work is required in several areas, the HYLIFE hybrid concept appears to be viable both technically and economically when compared with pure fusion and fast fission blanket hybrid concepts.

34121 (CONF-801011—(Vol.2), pp 1526-1536) **Fusion-fission combinations with DT and DD fuels.** Parish, T.A. (Texas A and M Univ., College Station). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Evaluations of fusion-fission combinations are carried out to determine their performance characteristics and their economic potential. Results for systems utilizing both DT and DD fuels are presented and compared. The ability of hybrids to meet growing energy demand is modeled using the doubling time approach. To assess the economic feasibility of hybrid systems, breakeven unit capital cost ratios (hybrid to client) are computed as a function of the client's fuel to capital cost ratio assuming the client to be fueled from a conventional source. Both fast fission and fission suppressed blankets are studied.

34122 (CONF-801011—(Vol.2), pp 1537-1554) **Characteristics of a spectral-shift blanket for hybrid reactor application.** Pettus, W.G. (Babcock and Wilcox Co., Lynchburg, VA). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Fusion-fission hybrid reactors represent one of only three energy-producing systems that appear feasible for large-scale central-station electric power generation over the very long-term. They have potential advantages over fission breeders in regard to safety, breeding performance, and fissile resource utilization. In comparison with pure fusion systems they can be developed sooner with greater reliance on existing technology and without the requirement of an ignited plasma. In addition, they facilitate a synergistic relationship with fission systems during the transition to pure fusion.

34123 (CONF-801011—(Vol.2), pp 1555-1568) **Comparison of wetted-wall and magnetically protected-wall inertial fusion hybrid concepts.** Reupke, W.A.; Cullingford, H.S. (Los Alamos Scientific Lab., NM). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Four conceptual designs of hybrid inertial fusion systems based on the wetted or magnetically protected first-wall protection schemes are compared. Each first-wall protection scheme was developed with a high- or low-power-density blanket to evaluate power and fissile fuel production levels. The comparison shows that a magnetically protected-wall reactor with a low-power-density blanket provides maximum annual fissile fuel generation with an attractive fuel cycle time.

34124 (CONF-801011—(Vol.2), pp 1589-1597) **Fuel cycle issues for suppressed fission-fusion breeders.** Berwald, D.H. (TRW, Inc., Redondo Beach, CA); Engdahl, J.C.; Allen, W.O.; Massey, J.V. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Fuel cycle issues of the suppressed fission hybrid fuel breeder are considered as they relate to the overall economics and desirability of hybrid bred fuel. The key question of reprocessing low enrichment fuel economically is examined in light of a conceptual reprocessing plant design, to account for the impact of suppressing fission in the blanket on the reprocessing cost. The bred fuel quality is examined by considering the quantities of $^{232}U$ that are present in the bred fuel. The recycle of the fertile thorium fuel is also considered. In conclusion, it appears that the suppressed fission hybrid may offer much improved fuel quality, over fast fission hybrid bred fuel, deriving economy from the simplified technology in the blanket (not quantified) and the reprocessing (estimated costs).

34125 (CONF-801011—(Vol.2), pp 1614-1621) **Production of substitute natural gas by a fusion hybrid reactor coupled to a catalyzed coal gasification plant.** Ribe, F.L. (Univ. of Washington, Seattle); Woodruff, G.L.; McCormick, N.J.; Fryer, B.C.; Rowe, D.S. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A scoping design study has been performed for a hybrid reactor driven by a reverse-field pinch which provides heat for a catalyzed coal gasification plant. The catalyzed process makes it possible to use lower maximum temperatures (816°C or 510°C, depending on the design option selected) than normally required in synthetic fuel applications. The blanket uses uranium carbide particulate flowing fuel which is gravity driven. A design for a thermal output of 3130 MWt has an annual output of 2320 kg of plutonium

and methane having a total heating value of 6808 MWt. The economics are attractive relative to an all-fossil fuel plant.

**34126** (CONF-801011—(Vol.2), pp 1661-1672) **Progress in the development of the blanket structural material for fusion reactors.** Scott, J.L. (Oak Ridge National Lab., TN); Bloom, E.E.; Grossbeck, M.L.; Maziasz, P.J.; Wiffen, F.W.; Gold, R.E.; Holmes, J.J.; Reuther, P.C. Jr.; Rosenwasser, S.N. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The Alloy Development for Irradiation Performance Program has become more focused since the last Fusion Reactor Technology Conference two years ago. Since austenitic stainless steels and ferritic steels are candidate structural materials for the near-term reactors ETF and INTOR and austenitic stainless steel is also the preferred structural material for the steady-state commercial fusion reactor, STARFIRE, a vigorous experimental program is under way to identify the best alloy from each of these alloy classes and to provide the engineering data base in a timely manner. In addition the comprehensive program that includes high-strength Fe-Ni-Cr alloys, reactive and refractory metals, and advanced concepts continues in an orderly fashion.

**34127** (CONF-801011—(Vol.2), pp 1673-1682) **Surface radiation damage in molybdenum alloys irradiated.** Igata, N.; Kohyama, A. (Univ. of Tokyo, Japan). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The objectives of this investigation are to study the mechanism of blistering in molybdenum alloys and to develop new molybdenum alloys for the first wall of fusion reactors. The used materials are molybdenum, molybdenum rhenium and molybdenum niobium alloys. Those materials were irradiated with argon or helium ions using 400 keV Ion Accelerator. The orientation dependence of blistering in those materials were clearly observed. The results were different depending on alloying elements. The temperature dependences of morphology of blistering and flaking were observed by scanning electron microscope. The mechanism for blistering is suggested from the observation of internal structures. Surface erosion in Mo-Tic eutectoid was also investigated.

**34128** (CONF-801011—(Vol.2), pp 1683-1689) **In-situ observation of radiation damage by 400 keV heavy ions.** Ishino, S.; Kawanishi, H.; Fukuya, K. (Univ. of Tokyo, Japan). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A facility for in-situ observation of heavy-ion radiation damage has been constructed at the Nuclear Engineering Research Laboratory of the University of Tokyo. This combines a 400 keV heavy-ion accelerator with a 200 keV electron microscope, with the ion beam entering at an angle of 45° to the electron beam axis of the microscope. Brief descriptions are made on the accelerator and the beam transport system. Some observations on solution treated SUS 316 stainless steel irradiated with 300 and 400 keV $Ar^+$ ions at relatively low temperatures ($\leqq 100°C$) are described. Technical problems which need further improvements are summarized.

**34129** (CONF-801011—(Vol.2), pp 1690-1701) **Critical materials problems in INTOR.** Kulcinski, G.L. (Univ. of Wisconsin, Madison). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Even though the INTOR reactor is conceived to be a near term device, there are still a few materials problems that require considerably more research. One of the more critical problems is the first wall which must handle heat loads of more than 20 W/cm², charge exchange neutral fluxes of $\sim 3 \times 10^{16}$ s$^{-1}$, as many as 2000 disruptions, and neutron fluences of over 6 MWy/m². This article discusses the ability of steel and aluminum first walls to withstand those conditions for the lifetime of the device.

**34130** (CONF-801011—(Vol.2), pp 1734-1739) **Status of FMIT.** Trego, A.L. (Hanford Engineering Development Lab., Richland, WA). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The Fusion Materials Irradiation Test (FMIT) Facility is a high-flux, high-energy neutron source that will provide a fusion-like radiation environment for fusion reactor materials development. The neutrons will be produced in a nuclear stripping reaction by impinging a 35 MeV beam of deuterons from an Alarez-type linear accelerator on a flowing lithium target. The targets will be located in two identical irradiation test cells, either of which will provide an irradiation volume of 10 cm³ at an average neutron flux of $1.4 \times 10^{15}$ n/cm²-s and 500 cm³ at an average flux of $2.2 \times 10^{14}$ n/cm cm²-sec. This irradiation test volume will be at least 500 times larger than that of any other facility with comparable neutron energy and flux.

**34131** (CONF-801011—(Vol.2), pp 1747-1753) **Structural design tolerance of radiation swelling: a first step.** Creedon, R.L. (General Atomic Co., San Diego, CA). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The materials used near the plasma in a fusion reactor will lose structural properties and swell during irradiations. It is important to prevent the generation of unwanted loads due to this swelling since these will shorten the reactor life. Three examples are shown of structural designs which tolerate radiation swelling and the benefits of these designs are indicated. A new parameter of swelling sensitivity is suggested for material comparisons. It is hoped to show that swelling tolerant design is a major and early consideration in translating a reactor concept into hardware.

**34132** (CONF-801011—(Vol.2), pp 1764-1769) **Deuterium retention in titanium alloys exposed in PLT.** Chang, J.Y.; Tobin, A. (Grumman Aerospace Corp., Bethpage, NY). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Specimen strips of pure alpha titanium and beta titanium alloy were exposed to a range of up to 46 deuterium plasma discharges in the Princeton Large Torus Tokamak (PLT) under simulated first wall conditions, and the amount of trapped deuterium in these specimens was measured, using carbon as a calibration standard for trapping. The Deuterium Nuclear Microprobe was used to study the total trapped deuterium and the deuterium depth distribution in the exposed materials before and after annealing at 373 and 423°K. The Scanning Auger Microprobe was used to identify the effects of surface impurities on the deuterium distribution. Results indicate that about 20 to 40% of the incident deuterium was trapped by the surface and about 90% of the trapped deuterium remained in a 20A carbonaceous film deposited during plasma exposure. Annealing resulted in a gradual loss from the film. These results indicate the importance of impurity film formation which may play a dominating role in plasma-wall interactions at the first wall.

**34133** (CONF-801011—(Vol.2), pp 1770-1781) **Survey of lithium compounds for tritium breeding applications.** Caldwell, C.S.; Pettus, W.G.; Thornton, T.A.; Smith, L.A. (Babcock and Wilcox Co., Lynchburg, VA). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

This paper provides a survey of published references and information on the properties of lithium materials. The lithium compounds were selected for their potential interest in evaluation of tritium breeding systems. The survey results are intended for use as a quick reference, and to pinpoint areas where key data are lacking. A total of 28 lithium materials, including several chemical intermediates and starting materials were surveyed. Ceramic, metallic, and salt categories are represented. The property groups comprise thermal, physical, structural, thermochemical, mechanical, electrical/magnetic and chemical/corrosion. Special characteristics dealing with material preparation and tritium production were also includ-

ed. The 167 literature references cited were obtained primarily from computer searches using Engineering Index, Chemical Abstracts, and Energy Data Base. Manual searches using Chemical Abstracts and The Center for Information and Numerical Data Analysis and Synthesis (CINDAS) were also sources of information. To provide additional baseline information, nuclear cross-section data relevant to tritium production were extracted from the ENDF/B-V files and are presented graphically.

34134 (CONF-801011—(Vol.2), pp 1794-1801) **Status of low Z coatings for fusion reactor applications.** Whitley, J.B.; Mullendore, A.W.; Mattox, D.M. (Sandia National Labs., Albuquerque, NM). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A program to develop low atomic number structures for use in tokamak reactor application is making good progress. Several candidate low Z coatings have been selected and proof tested for their resistance to ion erosion, arc erosion and thermal fatigue. Chemical vapor deposited coatings of TiC, $TiB_2$ and B on graphite have been tested as limiters in ISX-B. The tokamak operation with the TiC and $TiB_2$ coated limiters was good with the TiC coating surviving the exposure with the least damage. Under the severe environment of neutral beam heated discharges, the TiC coating suffered some damage of an unknown origin but the tokamak operation was not seriously affected. Future work in this area will include continued evaluation of different coatings in addition to the development of new classes of materials based on our current understanding of material behavior in the tokamak reactor environment.

34135 (CONF-801011—(Vol.2), pp 1811-1816) **Finite-element analysis of the TEXTOR vacuum vessel under complex loading conditions.** Zatz, I.J. (Grumman Aerospace Corp., Bethpage, NY); Rogoff, P.; Butzek, D. Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

TEXTOR (Tokamak Experiment for Technology Oriented Research) is a fusion device focusing on the examination of plasma/wall interaction within the framework of the European fusion research program. The TEXTOR vacuum vessel consists of eight sections separated by eight bellows sections. The large vacuum vessel sections with divertor openings are subjected to the largest loads. Finite-element analyses were performed on such a vacuum vessel section under varied loading conditions in order to ascertain the behavior of this structure. The results indicate that this analyzed section of TEXTOR is adequately designed to withstand specific load cases that simulate actual reactor conditions.

34136 (CONF-801011—(Vol.2), pp 1817-1824) **Structural materials for large superconducting magnet systems: an assessment based on the large coil program.** Long, C.J. (Oak Ridge National Lab., TN). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The Large Coil Program is an experimental assembly of six large superconducting magnets in a toroidal array and a test facility. These constitute a major fraction of the new generation of large and complex devices that operate at 4°K and require thorough, detailed engineering. The magnets are designed to a common set of performance and interface standards by six different industrial teams to simulate conditions in a tokamak. Design of the magnets and the facility has forced cryogenic materials technology. This paper will explore the structural and mechanical aspects of all materials, including the conductor, but exclude electrical behavior.

34137 (CONF-801011—(Vol.2), pp 1825-1832) **Materials application in neutral beam injectors and RF heating systems.** Davis, J.W.; Wille, G.W. (McDonnell Douglas Astronautics Company, St. Louis, MO). Jul 1981. NTIS, PC A22/MF A01. Order Number DE81027360.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Two promising methods of supplemental plasma heating are neutral beam injection and radiofrequency waves. This study examines the operational requirements for the two systems and identifies components of these systems in which material selection can play a key role in the systems' achieving their overall performance objective. The need to understand the issues relating to material selection becomes increasingly important when one considers that the next generation experimental machine will have an operating environment approaching that of a commercial device and as a result radiation damage resistance will become a significant factor in material selection.

34138 **(CONF-801011—(Vol.3)) Technology of controlled nuclear fusion.** Tenney, F.H.; Hopkins, C.C. (eds.). (Department of Energy, Washington, DC (USA)). Jul 1981. 644p. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Separate abstracts were prepared for 37 of the included papers. Abstracts for the remaining papers appeared previously in ERA. (MOW)

34139 (CONF-801011—(Vol.3), pp 595-617) **Design considerations for a high temperature $Li_2O$ flowing particulate blanket.** Rowe, D.S. (Rowe and Associates, Bellevue, WA); Woodruff, G.L.; Busch, R.A. Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

This paper considers a high temperature $Li_2O$ flowing particulate blanket for use with a fusion-driven thermochemical hydrogen production process. The major design issues are high temperature materials performance, tritium breeding, and particle flow characteristics. This concept offers significant advantages, notably simplicity and attractive breeding ratios. The feasibility of the concept depends critically on the maximum operating temperature. At temperatures above about 1100K particle coatings will be required to prevent sintering. Vaporization and accompanying rates of material transport and deposition can be expected at about 1200K depending in part on the presence of water vapor for hydration. Some type of zoned configuration is required to differentially control flow rates.

34140 (CONF-801011—(Vol.3), pp 618-627) **Stability of the lithium waterfall first wall protection concept for inertial confinement fusion reactors.** Esser, P.D.; Paul, D.D.; Abdel-Khalik, S.I. (Univ. of Wisconsin, Madison). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Uncertainties regarding the feasibility of using an annular waterfall of liquid lithium to protect the first wall in inertial confinement fusion (ICF) reactor cavities have prompted a theoretical investigation of annular jet stability. Infinitesimal perturbation techniques are applied to an idealized model of the jet with disturbances acting upon either or both of the free surfaces. Dispersion relations are derived which predict the range of disturbance frequencies leading to instability, as well as the perturbation growth rates and jet breakup length. The results are extended to turbulent annular jets and are evaluated for the lithium waterfall design. It is concluded that inherent instabilities due to turbulent fluctuations will not cause the jet to break up over distances comparable to the height of the reactor cavity.

34141 (CONF-801011—(Vol.3), pp 654-663) **Neutronic and thermal performance of a blanket design for an inertially confined fusion commercial power reactor.** Lee, A.Y.; Green, L.; Jedruch, J. (Westinghouse Electric Corp., Pittsburgh, PA). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Two conceptual designs for inertially confined fusion reactor power plants were developed. One design was based on a $CO_2$ laser driver and the other one on a heavy ion beam driver. The reactor chamber and the blanket were, however, the same for both designs.

The neutronic and thermal performance of the blanket system is described in this paper.

34142 (CONF-801011—(Vol.3), pp 664-673) **Poloidal divertor target for SLPX.** Luzzi, T. (Grumman Aerospace Corp., Bethpage, NY). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A single null poloidal divertor was planned for the Superconducting Long Pulse Experiment (SLPX) Tokamak Reactor, a conceptual design study conducted by the Princeton Plasma Physics Laboratory. This paper presents the divertor target design for SLPX. A discussion of the advantages and disadvantages of the two types of targets, actively cooled flat plates and cooling tubes is presented. Surface boiling swirl tubes and axial flow nucleate boiling tubes are examined and candidate cooling tubes for SLPX are chosen from existing experimental burnout data. The required equations and a procedure are developed for the design of a poloidal divertor target, and applied to the SLPX target design. The requirements of remote maintenance and its effect on the choice of a target are discussed. An analysis of the energy leaving a target tube, a measure of target performance, is conducted.

34143 (CONF-801011—(Vol.3), pp 674-683) **First-wall/blanket design for the STARFIRE tokamak reactor.** Morgan, G.D. (McDonnell Douglas Astronautics Co., St. Louis, MO); Stones, P.B.; Smith, D.L.; Stevens, H.C.; Gohar, Y.; Misra, B. Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The design of the first-wall/blanket system for the STARFIRE commercial tokamak reactor conceptual design is discussed. Selection of the materials and design elements for the first-wall/blanket design were most strongly influenced by the STARFIRE project design guidelines of environmental and economic attractiveness, inherent safety, and credibility of engineering solutions to design problems. The reference design features a solid tritium breeder (varies as -$LiAlO_2$), a solid neutron multiplier (Be or $Zr_5Pb_3$), pressurized water coolant, and a titanium-modified austenitic stainless steel structure in the high-fluence region. The first wall is a Be-coated corrugated panel. The neutron multiplier is in slab form immediately behind the first wall. Breeder coolant is contained in small-diameter tubes; two independent primary coolant loops are utilized throughout each blanket module. Maintenance is accomplished by removal and replacement of first-wall/blanket sectors. Predicted design life is six years at an average neutron wall load of 3.6 $MW/m^2$ and a plant availability of 75%.

34144 (CONF-801011—(Vol.3), pp 684-691) **Experimental investigation of the convective heat transfer characteristics of particle-bed type fusion blankets.** Nietert, R.E.; Abdel-Khalik, S.I. (Univ. of Wisconsin, Madison). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

An experimental investigation has been conducted to determine the heat transfer characteristics of gravity-flowing particle beds. A heat transfer loop has been constructed for such a purpose. Glass microspheres have been allowed to flow by gravity at controlled rates through an electrically heated stainless steel tubular test section. Values of the local and average convective heat transfer coefficient as a function of the average bed velocity, particle size and heat flux have been determined. Such information is necessary for the design of gravity flowing particle-bed type fusion reactor-blankets and associated tritium recovery systems.

34145 (CONF-801011—(Vol.3), pp 692-701) **Electric field bumpy torus plasma as a test bed for plasma-wall interaction studies.** Roth, J.R. (Univ. of Tennessee, Knoxville). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The Electric Field Bumpy Torus (EFBT) plasma is capable of producing steady-state fluxes of Maxwellianized ions with kinetic temperatures on the order of a keV, and can do so at an ion heating cost of 10 cents per watt. These ions can be supplied at fluxes which equal or exceed those characteristic of space-charge limited ion sources. The deuterium ion fluxes measured at the surface of the EFBT plasma have been as high as $5 \times 10^{19}$ ions/$M^2$-sec (8.0 amps/$M^2$) in the steady-state, and on the order of $2 \times 10^{22}$ ions/$10^{22}$ $M^2$-sec (3200 amps/$M^2$) on the electrode surfaces. This plasma has achieved average number densities up to $3 \times 10^{12}$ ions per cubic centimeter, and ion kinetic temperatures up to 500 eV for the above fluxes. The EFBT plasma is therefore an attractive candidate to supply large fluxes and fluences of ions for studies related to divertors, limiters, and first wall bombardment.

34146 (CONF-801011—(Vol.3), pp 765-773) **Moving ring field-reversed mirror blanket design considerations.** Wong, C.P.C.; Cheng, E.T.; Creedon, L.; Kessel, C.; Norman, J.; Schultz, K.R. (General Atomic Co., San Diego, CA). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A blanket design for the Moving Ring Field-Reversed Mirror Reactor (MRFRM) is presented in this paper. The design emphasis is placed on minimizing the induced radioactivities in the first-wall, blanket and shield. To this end, aluminum-alloy was selected as the reference structural material, giving dose rates two weeks after shutdown that are 3 to 4 orders of magnitude lower than comparable steel structures. The aluminum first-wall is water-cooled and thermally insulated from the high temperature SiC-clad $Li_2O$ tritium breeding zone. A local tritium breeding ratio of 1.05 was obtained for the design. The tritium is extracted from the $Li_2O$ by the use of a small dry helium purge stream through the SiC tubes. About 1 ppM hydrogen is added to the helium purge stream to enhance the tritium recovery rate. Helium at 28 atmospheres pressure is circulated through the blanket and shield, with an outlet temperature of 850°C, which is coupled with an existing small size closed-cycle gas turbine (CCGT) power conversion system. The spatial and temporal variations of the first-wall temperature caused by the translational movement of the plasma rings along the axis of the cylindrical reactor were evaluated. The after-heat cooling problems of the first-wall were also considered.

34147 (CONF-801011—(Vol.3), pp 782-787) **Lithium blanket module tests on the TFTR.** Jassby, D.L.; File, J.; Little, R.; Lontai, L.M. (Princeton Univ., NJ). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The TFTR will be the only magnetic-confinement fusion device for at least the next 10 years that offers the opportunity for blanket module neutronics experiments using a reactor-prototypic extended fusion neutron source and neutron spectrum. In order to evaluate the potential of this unique opportunity, the Electric Power Research Institute in 1979 sponsored a Technical Planning Study on the subject of TFTR Fusion Blanket Experiments. The report resulting from that study recommended - (1) that an Engineering Test Station be implemented for the structural support and servicing of blanket modules adjacent to the vacuum vessel of the TFTR; and (2) that the first blanket module be designed for tritium-breeding experiments. In October 1979, an EPRI-sponsored program was initiated at PPPL to carry out these recommendations. TARs paper summarizes the status of the program as of October 1980.

34148 (CONF-801011—(Vol.3), pp 815-824) **Design of tandem mirror reactors with thermal barriers.** Carlson, G.A. (Lawrence Livermore National Lab., CA). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

End-plug technologies for tandem mirror reactors include high-field superconducting magnets, neutral beam injectors, and gyrotrons for electron cyclotron resonant heating (ECRH). In addition to their normal use for sustenance of the end-plug plasmas, neutral beam injectors are used for pumping trapped ions from the thermal barrier regions by charge exchange. An extra function of the axially directed pump beams is the removal of thermalized

alpha particles from the reactor. The principles of tandem mirror operation with thermal barriers will be demonstrated in the upgrade of the Tandem Mirror Experiment (TMX-U) in 1981 and the tandem configuration of the Mirror Fusion Test Facility (MFTF-B) in 1984. Continued analysis and conceptual design over this period will evolve the optimal configuration and parameters for a power producing reactor.

**34149** (CONF-801011—(Vol.3), pp 840-853) **Conceptual design of a compact field reversed mirror reactor: SAFFIRE.** Gilligan, J.G.; Miley, G.H.; Driemeyer, D. (Univ. of Illinois, Urbana). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The objective of this study was to design a compact Field Reversed Mirror Reactor with emphasis on near-term, steady state operation. A global plasma model is coupled with a Monte Carlo treatment of fusion product slowing down to arrive at reference plasma parameters. Component design of a pilot plant (SAFFIRE) and small (< 100 MWe) power reactor is reported.

**34150** (CONF-801011—(Vol.3), pp 871-884) **OHTE confinement test, an engineering overview.** Puhn, F.A.; Jackson, G.L. (General Atomic Co., San Diego, CA). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

An alternate fusion concept has been developed by General Atomic Company which promises significant advantages over other magnetic confinement systems. The new concept is named OHTE (Ohmically Heated Toroidal Experiment), and will be tested in a small device at General Atomic Company. The OHTE plasma confinement system uses a toroidal helical coil in conjunction with an ohmic heating coil. In a D-T reactor embodiment, OHTE is predicted to be capable of ohmic heating to ignition.

**34151** (CONF-801011—(Vol.3), pp 885-893) **Moving-ring field-reversed mirror reactor.** Smith, A.C. Jr. (Pacific Gas and Electric Co., San Francisco, CA); Ashworth, C.P.; Abreu, K.E. Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

We describe a first prototype fusion reactor design of the Moving-Ring Field-Reversed Mirror Reactor. The fusion fuel is confined in current-carrying rings of magnetically-field-reversed plasma. The plamsa rings, formed by a coaxial plasma gun, are magnetically compressed to ignition temperature while they are being injected into the reactor's burner section. DT ice pellets refuel the rings during the burn at a rate which maintains constant fusion power. A steady train of plasma rings moves at constant speed through the reactor under the influence of a slightly diverging magnetic field. The aluminum first wall and breeding zone structure minimize induced radioactivity; hands-on maintenance is possible on reactor components outside the breeding blanket. Helium removes the heat from the $Li_2O$ tritium breeding blanket and is used to generate steam. The reactor produces a constant, net power of 376 MW(e).

**34152** (CONF-801011—(Vol.3), pp 894-902) **TRACT fusion reactor studies.** Willenberg, H.J.; Steinhauer, L.C.; Hoffman, A.L.; Churchill, T.L.; Rose, P.H. (Mathematical Sciences Northwest, Inc., Bellevue, WA). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The TRACT plasma concept appears to offer the promise of small fusion power reactors which can greatly reduce the financial risk associated with the commercial fusion power development program. The TRACT plasma formation and heating process is described, and a preliminary design of a small reactor which produces net electrical power is reviewed. Specific design items addressed include: plasma heating, magnet design and reliability, breeding blanket feasibility, and a maintenance concept. Preliminary power plant cost estimates are also presented.

**34153** (CONF-801011—(Vol.3), pp 905-912) **Potential and status of alternate-fuel fusion.** Miley, G.H. (Univ. of Illinois, Urbana). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Alternate fuels (AFs) such as Cat-D, D-$^3$He and p-$^{11}$B offer the potential advantages of elimination of tritium breeding and reduced energy release in neutrons. However, to fully utilize deuterium based AFs, we may be required to develop a semi-catalyzed-D plant to generate $^3$He for D-$^3$He satellites. p-$^{11}$B plants could stand-alone, but an adequate energy balance appears exceedingly difficult to achieve. These approaches and problems are discussed.

**34154** (CONF-801011—(Vol.3), pp 946-954) **CAT-D-T tokamaks.** Greenspan, E.; Blue, T.; Miley, G.H. (Univ. of Illinois, Urbana). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The domains of plasma fuel cycles bounded by the D-T and Cat-D, and by the D-T and SCD modes of operation are examined. These domains, referred to as, respectively, the Cat-D-T and SCD-T modes of operation, are characterized by the number ($\gamma$) of tritons per fusion neutron available from external (to the plasma) sources. Two external tritium sources are considered - the blankets of the Cat-D-T (SCD-T) reactors and fission reactors supported by the Cat-D-T (SCD-T) driven hybrid reactors. It is found that by using $^6$Li for the active material of the control elements of the fission reactors, it is possible to achieve $\gamma$ values close to unity. Cat-D-T tokamaks could be designed to have smaller size, higher power density, lower magnetic field and even lower plasma temperature than Cat-D tokamaks; the difference becomes significant for $\gamma \geq .75$. The SCD-T mode of operation appears to be even more attractive. Promising applications identified for these Cat-D-T and SCD-T modes of operation include hybrid reactors, fusion synfuel factories and fusion reactors which have difficulty in providing all their tritium needs.

**34155** (CONF-801011—(Vol.3), pp 957-960) **Status of TFTR.** Grove, D.J. (Princeton Univ., NJ). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

This paper discusses the status of TFTR as of October 1980. Consideration is given to technical aspects as well as to construction and fabrication progress. Some discussion is also given on schedules and funding. Finally, some considerations of experimental research planning are presented.

**34156** (CONF-801011—(Vol.3), pp 964-969) **JT-60 project and its present status.** Iso, Y.; Yoshikawa, M. (Japan Atomic Energy Research Inst., Ibaraki-Ken). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

JT-60 is a large Tokamak device now under construction at Japan Atomic Energy Research Institute (JAERI). Its objective is to investigate and evaluate plasma confinement and heating in hydrogen plasmas at near-reactor conditions and to develop associated fusion technologies and assess them as integrated into a single device. The present paper describes the JT-60 project for its objectives, the JT-60 device, planned experiments, and its present status of construction and development.

**34157** (CONF-801011—(Vol.3), pp 976-984) **Mirror fusion test facility-B.** Karpenko, V.N. (Lawrence Livermore National Lab., CA). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A brief review of the facility and some future plans for upgrading the facility are given. (MOW)

**34158** (CONF-801011—(Vol.3), pp 985-995) **Shielding for TFTR.** Rappe, G.H. (Princeton Plasma Physics Lab., NJ); Perry, E.; Palmeri, A. Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

This paper will describe the proposed design of the radiation shielding for TFTR. The mechanical design conveniently breaks down into five major elements, the Tokamak floor, the igloo shielding for the neutral beams and vacuum vessel pumping ducts, shielding for the test cell walls and ceiling, and local shielding for the diagnostic area in the basement below the vacuum vessel. Considerable investigation has been carried out regarding suitable cements, aggregates, water soluble admixtures, and compatible water analyses. Our findings are described in detail with associated tables.

**34159** (CONF-801011—(Vol.3), pp 996-1001) **TFTR control and monitoring system (CICADA).** Daniels, R.E. (Princeton Univ., NJ). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The TFTR Central Instrumentation, Control and Data Acquisition System (CICADA) is described. This is a computer based system, supporting three types of user interfaces and supporting real time, terminal, and batch operations. Over one hundred graphic display generators will be supported by the system, four array processors will greatly increase the analysis capabilities, and closed circuit television will distribute performance data throughout the facility. Approximately twenty thousand points will be interfaced to the system.

**34160** (CONF-801011—(Vol.3), pp 1002-1008) **Remote handling methods on TFTR.** Young, N.E. (Ebasco Services, Inc., Princeton, NJ). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Remote operations for maintaining all systems within the Bulk Shielding or Igloo have been evaluated. This includes contingency operations such as segmentation as well as those normal maintenance operations such as limiter replacement, that are presently defined. This paper discusses the systems presently under consideration to accomplish the above tasks as well as the basic approach to machine design to facilitate remote maintenance.

**34161** (CONF-801011—(Vol.3), pp 1009-1016) **Design of the TFTR Zr/Al surface pumping panels.** Bundy, J.J. (Grumman Aerospace Corp., Bethpage, NY). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The Surface Pumping System being designed under the TFTR Flexibility Modification (TFM) program incorporates Zr/Al panels which act as the active gettering devices. This paper describes the requirements imposed on these panels, and the design features which satisfy them. Detailed discussions of the design, including drawings of the major features, follow. The design approach and geometric constraints are presented first, followed by descriptions of the major components and general arrangement.

**34162** (CONF-801011—(Vol.3), pp 1017-1023) **Thermal analysis of the TFTR surface pumping system.** Glicksman, J. (Grumman Aerospace Corp., Bethpage, NY). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A thermal analysis has been performed on the Zr/Al surface pumping system (SPS) selected for TFTR. This system requires periodic regeneration and reactivation operations during which the getter wafer module temperatures are elevated by electric resistive heating. The analysis was conducted to determine the thermal conditions existing during these operations. The vacuum vessel heat loads, temperatures of the various components within the vacuum vessel, and system power requirements were determined and found to be compatible with the TFTR design. Maximum heat loads of approximately 0.28 and 0.25 W/cm$^2$ were determined for the bellows and bare vacuum vessel shell, respectively. In addition, an analysis was conducted to establish the thermal profile within the pumping panel support structure.

**34163** (CONF-801011—(Vol.3), pp 1024-1033) **Surface pumping system for TFTR impurity and density control.** Sredniawski, J.J. (Grumman Aerospace Corp., Bethpage, NY). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

An explanation is given of the primary reasons for not selecting the titanium gettering approach, an overall system description of the zirconium/aluminum final design, a presentation of operational parameters and scenarios, and a discussion of remote handling and maintenance schemes.

**34164** (CONF-801011—(Vol.3), pp 1034-1037) **Special features of the TFTR vacuum vessel.** Citrolo, J.; Little, R. (Plasma Physics Lab., Princeton, NJ). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The Tokamak Fusion Test Reactor (TFTR) is a large tokamak being built at Princeton Plasma Physics Laboratory. It is intended to be the first US tokamak to use deuterium and tritium to provide significant numbers of fusion neutrons in a pulsed mode. The TFTR vacuum vessel is the primary container for the plasma, and has to satisfy a set of relatively unusual requirements in addition to the standard ones of vacuum integrity. This paper is a summary description of some of the interesting features of the vacuum vessel.

**34165** (CONF-801011—(Vol.3), pp 1055-1065) **ELMO Bumpy Torus Reactor.** Bathke, C.G. (Univ. of California, Los Alamos, NM); Dudziak, D.J.; Krakowski, R.A. Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The design bases and interim results of a conceptual design study of the ELMO Bumpy Torus Reactor (EBTR) are described. By direct coupling of critical engineering constraints, fundamental (neoclassical) transport processes, stability-related beta limits, electron-ring heating and classical loss processes, magnet design and blanket/shield performance, an EBTR design emerges that generates 1270-MWe gross power in a system with a toroidal radius of 35 m using aspect-ratio-enhancement coils. Although the conceptual engineering of this high-Q system is not complete, interim designs and solutions are presented. A summary of key physics and engineering issues requiring further investigation is also given.

**34166** (CONF-801011—(Vol.3), pp 1088-1095) **Utility impact on STARFIRE design.** DeFreece, D.A.; Waganer, L.M.; Woklenhauer, W.C. (McDonnell Douglas Astronautics Co., St. Louis, MO). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A primary objective of STARFIRE has been to design a tokamak fusion power plant that was attractive to the utilities. To achieve this goal, several utility representatives were directly involved in the decision-making processes as the design evolved. An initial step was to establish the relative importance to the utilities for an extensive list of economic, performance, safety and environmental issues. The top twenty issues were ranked. Cost of electricity was clearly most important with very little spread in the ratings of individual evaluators. Licensing is a go/no-go factor and must be accomplished for the other factors to have meaning. The top nine factors were judged to be very important by all evaluators, as was shown by the spread of ratings from 5 to 10. There is considerably more spread in the bottom eleven, which reflects a lack of consensus as to the relative importance of the evaluation factors. This evaluation was utilized in establishing the initial design concept.

**34167** (CONF-801011—(Vol.3), pp 1103-1114) **Power conversion and balance of plant considerations for the STARFIRE commercial tokamak reactor.** Barry, K. (Ralph M. Parsons Co., Pasadena, CA); Graumann, D. Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

The power conversion and balance of plant facilities for this tenth-of-a-kind tokamak fusion power plant are a combination of both features common to any large power plant, and elements peculiar to the fusion technology. For example, the steam generators, turbine-generator and main condenser components of the power conversion system and the natural draft cooling towers that are used for heat rejection at sites not close to a large body of water are generic to power plants. The tritium reprocessing facilities that minimize the tritium inventory in the plant, the Electrical and RF Power Supply Building that contains the coil and rf power supplies, the cryogenic facilities that provide liquid helium coolant for the superconducting coils, and the Hot Cell in which fully remote repair and maintenance functions are performed are unique to a fusion power plant. One of the major features of the STARFIRE design is steady state operation that maximizes overall facility reliability and eliminates both thermal storage requirements and potential power fluctuations on the grid. The reference reactor power is 4000 MWt with a gross electric power generation of 1440 MW. For STARFIRE, water is the preferred coolant and is utilized in both the first wall/blanket and limiter cooling circuits. Dual parallel primary coolant loops cool the twenty-four first-wall/blanket sectors. The power deposited in the limiter, approximately 5% of the total thermal power, is removed by the separate limiter/feedwater loop and is used for feedwater heating in the steam power conversion system.

**34168** (CONF-801011—(Vol.3), pp 1115-1119) **Electron-beam-driven, compact, steady-state tokamaks.** Bailey, V.; Benford, J.; Cooper, R.; Teofilo, V.L. (Physics International Co., San Leandro, CA). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Intense relativistic electron beam (REBs) can be injected and trapped in toroidal magnetic fields and plasmas to supply both heating and poloidal confining fields. A compact, simpler reactor is achieved by replacement of the ohmic and auxiliary heating for startup, and the toroidal current is sustained for steady-state operation. We present a reactor concept which illustrates the compactness, simplicity, high gain, and steady-state performance desired for a fusion power plant.

**34169** (CONF-801011—(Vol.3), pp 1143-1151) **Bundle divertor studies.** Bateman, G.; Theriault, P.; Morris, R.N. (Georgia Inst. of Tech., Atlanta). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

A series of bundle divertor designs are presented for an INTOR or ETF size fusion reactor satisfying design constraints on the allowable space for shielding, coil stress, cooling requirements, and heat flux through the divertor throat. An optimum design is chosen based on the magnitude and character of the magnetic ripple induced in the plasma.

**34170** (CONF-801011—(Vol.3), pp 1205-1216) **Design studies of commercial magnetic fusion reactors.** Conn, R.W. (Univ. of California, Los Angeles). Jul 1981. NTIS, PC A99/MF A01. Order Number DE81027361.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

Advances in magnetic fusion commercial reactor design studies are reviewed with emphasis on the directions of such designs (and their requirements) and their impact on the experimental plasma program. Discussed are the tokamak, tandem mirror, reversed field pinch and bumpy torus.

**34171** **(DOE/ET/51013—6) Novel limiter pump topologies.** Schultz, J.H. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center; Oak Ridge National Lab., TN (USA)). 1981. Contract AC02-78ET51013. 33p. NTIS, PC A03/MF A01. Order Number DE81030029.

The use of limiter pumps as the principle plasma exhaust system of a magnetic confinement fusion device promises significant simplification, when compared to previously investigating divertor based systems. Further simplifications, such as the integration of the exhaust system with a radio frequency heating system and with the main reactor shield and structure are investigated below. The integrity of limiters in a reactor environment is threatened by many mechanisms, the most severe of which may be erosion by sputtering. Two novel topologies are suggested which allow high erosion without limiter failure.

**34172** **(GA-A—16384) Performance of TiC-coated graphite in electron-beam tests and Doublet III operation.** Sevier, D.L.; Trester, P.W.; Hopkins, G.; McKelvey, T.E.; Taylor, T.S. (General Atomic Co., San Diego, CA (USA)). Jun 1981. Contract AT03-76ET510111. 9p. (CONF-810831—39). NTIS, PC A02/MF A01. Order Number DE81029132.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Power density limits were determined as a function of time for titanium carbide coated POCO graphite exposed to a localized electron beam. Typical coating degradations are reviewed and compared to the deterioration of the TiC coating of the Doublet III (DIII) graphite limiter. The design of the movable primary limiter and its operational performance in DIII are reviewed.

**34173** **(HEDL-SA—2340FP) Neutron environment in d + Li facilities.** Mann, F.M.; Schmittroth, F.; Carter, L.L. (Hanford Engineering Development Lab., Richland, WA (USA)). 1981. Contract AC14-76FF02170. 10p. (CONF-810831—46). NTIS, PC A02/MF A01. Order Number DE81029803.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Thick target neutron yields from the d + Li reaction are calculated using simple models that agree well with measured values. The models are used to infer the neutron environment in d + Li facilities such as the FMIT facility.

**34174** **(HEDL-SA—2476-FP) Instrumented in-reactor test capabilities in FFTF.** Bauer, R.E. (Hanford Engineering Development Lab., Richland, WA (USA)). 11 Jun 1981. Contract AC14-76FF02170. 7p. (CONF-810831—42). NTIS, PC A02/MF A01. Order Number DE81029775.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Fusion materials research and development requires high neutron fluxes coupled with a large irradiation volume. Both of these needs can be provided by the Fast Test Reactor in the Fast Flux Test Facility. The Materials Open Test Assembly, the vehicle used for materials irradiations in the FFTF, is described.

**34175** **(LA—8114-PR) Inertial fusion program, January 1-June 30, 1979.** Skoberne, F. (comp.). (Los Alamos National Lab., NM (USA)). Jun 1981. Contract W-7405-ENG-36. 196p. NTIS, PC A09/MF A01. Order Number DE81030512.

Progress in the development of high-energy short-pulse carbon dioxide laser systems for fusion research is reported. Improvements are outlined for the Los Alamos National Laboratory's Gemini System, which permitted over 500 shots in support of 10 different target experiments; the transformation of our eight-beam system, Helios, from a developmental to an operational facility that is capable of irradiating targets on a routine basis is described; and progress made toward completion of Antares, our 100- to 200-TW target irradiation system, is detailed. Investigations of phenomena such as phase conjugation by degenerate four-wave mixing and its applicability to laser fusion systems, and frequency multiplexing as a means toward multipulse energy extraction are summarized. Also discussed are experiments with targets designed for adiabatic compression. Progress is reported in the development of accurate diag-

nostics, especially for the detection of expanding ions, of neutron yield, and of x-ray emission. Significant advances in our theoretical efforts are summarized, such as the adaptation of our target design codes for use with the CRAY-1 computer, and new results leading to a better understanding of implosion phenomena are reported. The results of various fusion reactor studies are summarized, including the development of an ICF reactor blanket that offers a promising alternative to the usual lithium blanket, and the formulation of a capital-cost data base for laser fusion reactors to permit meaningful comparisons with other technologies.

34176 **(LA-UR—81-2468) Optical analysis and alignment applications using the infrared Smartt interferometer.** Viswanathan, V.K.; Bolen, P.D.; Liberman, I.; Seery, B.D. (Los Alamos National Lab., NM (USA); Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center; TRW, Inc., Redondo Beach, CA (USA). Applied Technology Div.). 1981. Contract W-7405-ENG-36. 7p. (CONF-810429—38). NTIS, PC A02/MF A01. Order Number DE81030257.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

The possibility of using the infrared Smartt interferometer for optical analysis and alignment of infrared laser systems has been discussed previously. In this paper, optical analysis of the Gigawatt Test Facility at Los Alamos, as well as a deformable mirror manufactured by Rocketdyne, are discussed as examples of the technique. The possibility of optically characterizing, as well as aligning, pulsed high energy laser systems like Helios and Antares is discussed in some detail.

34177 **(LA-UR—81-2469) Optical tooling for Antares.** Bauke, W.; Saxman, A.C.; O'Kay, N. (Los Alamos National Lab., NM (USA); Nelson and Johnson Engineering, Boulder, CO (USA)). 1981. Contract W-7405-ENG-36. 9p. (CONF-810429—39). NTIS, PC A02/MF A01. Order Number DE81030256.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

The Antares laser system is a large (40 kJ) $CO_2$ pulse laser system. High energy pulses are transmitted between buildings over path lengths exceeding 90 m. The optical elements are contained within large steel assemblies (power amplifiers, turning chambers, and target chamber) which must be positioned with tolerances of 0.75 mm. The subassemblies of optical components must be prepositioned to a precision of 0.25 mm. This precision can easily be obtained by first order surveying techniques and instrumentation. This paper describes the use of a combination of traditional surveying techniques and modern optical tooling methods throughout the integration of building reference planes and the erection of major steel assemblies. The design and measured assembly tolerances are compared.

34178 **(LA-UR—81-2523) Phase aberrations and beam cleanup techniques in carbon-dioxide laser fusion systems.** Viswanathan, V.K. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810810—25). NTIS, PC A02/MF A01. Order Number DE81030139.

From SPIE international symposium; San Diego, CA, USA (24 Aug 1981).

This paper describes the various carbon dioxide laser fusion systems at Los Alamos from the point of view of an optical designer. The types of phase aberrations present in these systems, as well as the beam cleanup techniques that can be used to improve the beam optical quality, are discussed. As this is a review article, some previously published results are also used where relevant.

34179 **(LA-UR—81-2524) Use of Zernike polynomials and interferometry in the optical design and assembly of large carbon-dioxide laser systems.** Viswanathan, V.K. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 10p. (CONF-810810—24). NTIS, PC A02/MF A01. Order Number DE81030138.

From SPIE international symposium; San Diego, CA, USA (24 Aug 1981).

This paper describes the need for non-raytracing schemes in the optical design and analysis of large carbon-dioxide lasers like the Gigawatt, Gemini, and Helios lasers currently operational at Los Alamos, and the Antares laser fusion system under construction. The scheme currently used at Los Alamos involves characterizing the various optical components with a Zernike polynomial set obtained by the digitization of experimentally produced interferograms of the components. A Fast Fourier Transform code then propagates the complex amplitude and phase of the beam through the whole system and computes the optical parameters of interest. The analysis scheme is illustrated through examples of the Gigawatt, Gemini, and Helios systems. A possible way of using the Zernike polynomials in optical design problems of this type is discussed. Comparisons between the computed values and experimentally obtained results are made and it is concluded that this appears to be a valid approach. As this is a review article, some previously published results are also used where relevant.

34180 **(LBL—12995) Production and destruction of $D^-$ by charge transfer in metal vapors.** Schlachter, A.S. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 27p. (CONF-810442—4). NTIS, PC A03/MF A01. Order Number DE81028134.

From Joint workshop on negative ions; Mexico City, Mexico (1 Apr 1981).

Experimental studies of $D^-$ collisions are of interest for basic physics, where experimental results can be used to test theoretical models for charge transfer, and for applications to ion sources for accelerators and for heating magnetically confined plasmas of interest for fusion. The high $D^-$ yield from charge transfer in a thick cesium-vapor target is consistent with recent cross-section calculations and measurements. Recent theoretical calculations of cross sections in thick alkaline-earth-vapor targets, leading to prediction of a large $D^-$ yield at low energy, have been partially confirmed in recent measurements, in which a $D^-$ yield of 50% was observed at a D energy of 500 eV.

34181 **(ORNL/TM—7879) Electrode design and performance of the ORNL positive ion sources.** Whealton, J.H.; Gardner, W.L.; Haselton, H.H. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 84p. NTIS, PC A05/MF A01. Order Number DE81030426.

The neutral beam development group at ORNL has designed, constructed, and shipped four 50-kV, 100-A sources to PPL to be used for neutral beam heating of the confined plasma on the PDX tokamak. These sources have higher current capability than scaled-down sources, and they are required to run for 0.5 s as opposed to the 0.3-s requirement for PLT and ISX-B sources. Due to an innovative electrode design, these higher power sources met these requirements and achieved a higher transmission efficiency - 76% of the total input power on target vs 60% for the original ISX-B and modified PLT sources or 40% for the original PLT sources. Using the same electrode design with a tetrode accelerating structure and a new, indirectly heated cathode, repeatable long pulse, high energy conditions of 70 kV, 7 A, 8 s, and 90 kV, 9 A, 5 s were achieved. Grid deformation calculations and Monte Carlo beam line gas deposition algorithms will be discussed. A direct-magnetic-electron-blocking, direct-recovery device is described, and theoretical considerations of it are discussed.

34182 **(PPPL—1832) Stellarator program.** Johnson, J.L.; Grieger, G.; Lees, D.J.; Rabinovich, M.S.; Shohet, J.L.; Uo, K. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1981. Contract AC02-76CH03073. 20p. NTIS, PC A02/MF A01. Order Number DE81030386.

The worldwide development of stellarator research is reviewed briefly and informally.

34183 **(SAND—81-1472) Phoenix II energy extraction and angular multiplexing experiments.** Hoffman, J.M.; Hays, G.N. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 49p. NTIS, PC A03/MF A01. Order Number DE81028972.

The energy extraction efficiency as a function of input intensity has been determined from a large-volume HF amplifier. For an input intensity of 4 x $10^6$W/cm$^2$, 1080 Joules was extracted from

the amplifier. This corresponded to an energy extraction efficiency of 0.90. At the highest $H_2/F_2/O_2$ pressures used, 1700 Joules was obtained from this system when used in an oscillator configuration. These results also show evidence that energy extraction at low input intensities in large-volume HF amplifiers is strongly influenced by parasitic oscillations. The results also indicate that, for a long-pulse HF amplifier (60-nsec electron beam), the timing between the amplifier and oscillator to achieve optimum operating conditions is not very critical. This same amplifier, used in conjunction with a short-pulse, good-beam-quality oscillator-preamplifier chain, has also been used to evaluate pulse compression using angular multiplexing. Using two sequential 24-nsec pulses, the essential elements of angular multiplexing have been evaluated as a function of interpulse separation time. Included are energy extraction efficiency, overall temporal pulse distortion, leading-edge contrast-ratio distortion, and suppression of amplified spontaneous emission relative to a single, long-duration input pulse. For appropriate interpulse delay time, we show that distortionless amplification is possible with energy-extraction efficiency the same as is obtained using a single input beam having a pulse width equal to the duration of the amplifier gain.

34184 **(SAND—81-1864C) Survey of atomic physics issues in experimental inertial confinement research.** Hauer, A.; Burns, E.J.T. (Sandia National Labs., Albuquerque, NM (USA); Los Alamos National Lab., NM (USA)). 1981. Contract AC04-76DP00789. 14p. (CONF-810754—2). NTIS, PC A02/MF A01. Order Number DE81028389.

From 12. IPEAC international conference on the physics of electronics and atomic collisions; Gatlinburg, TN, USA (15 Jul 1981).

Atomic processes impact many of the interactions important to inertial confinement fusion. For example, ionization of bound electrons represent one of the primary stopping mechanisms for both ions and electrons. Atomic processes are also important in predicting the behavior of the very dense plasmas which are central to the success of inertial fusion. Atomic spectroscopy is an important diagnostic of ICF plasmas.

34185 **(UCID—19176) Streak camera measurements of laser pulse temporal dispersion in short graded-index optical fibers.** Lerche, R.A.; Phillips, G.E. (Lawrence Livermore National Lab., CA (USA)). 28 Aug 1981. Contract W-7405-ENG-48. 14p. NTIS, PC A02/MF A01. Order Number DE81030308.

Streak camera measurements were used to determine temporal dispersion in short (5 to 30 meter) graded-index optical fibers. Results show that 50-ps, 1.06-μm and 0.53-μm laser pulses can be propagated without significant dispersion when care is taken to prevent propagation of energy in fiber cladding modes.

34186 **(UCRL—85645) Aberrations and focusability in large solid-state-laser systems.** Simmons, W.W. (Lawrence Livermore National Lab., CA (USA)). 1981. Contract W-7405-ENG-48. 25p. (CONF-810810—26). NTIS, PC A02/MF A01. Order Number DE81029914.

From SPIE international symposium; San Diego, CA, USA (24 Aug 1981).

Solid state lasers for fusion experiments must reliably deliver maximum power to small (approximately .5 mm) targets from stand-off focal distances of 1 m or more. This requirement places stringent limits upon the optical quality of the several major components - amplifiers, Faraday isolators, spatial filters - in each amplifier train. Residual static aberrations in optical components are transferred to the beam as it traverses the optical amplifier chain. Although individual components are typically less than $\lambda/20$ for components less than 10 cm clear aperture; and less than $\lambda/10$ for components less than 20 cm clear aperture; the large number of such components in optical series results in a wavefront error that may exceed one wave for modern solid state lasers. For pulse operation, the focal spot is additionally broadened by intensity dependent nonlinearities. Specific examples of the performance of large aperture components will be presented within the context of the Argus and Shiva laser systems, which are presently operational at Lawrence Livermore National Laboratory. Design requirements upon the larger aperture Nova laser components, up to 74 cm in clear aperture, will also be discussed; these pose a significant challenge to the optical industry.

34187 **Effect of wall loading limitations and choice of beta on the feasibility of advanced fuel fusion reactors.** Roth, J.R.; Roland, H.C. (Univ. of Tennessee, Knoxville). *Journal of Fusion Energy ;* **1**: No. 2, 117-127(Apr 1981).

This paper investigates the effect of wall loading limitations and choice of plasma stability index beta on the feasibility of advanced fuel fusion reactors. Two new conceptual tools are introduced to facilitate this analysis: the effective reactivity, which includes all of the reaction-relevant parameters that determine the fusion power density, and the critical radius, which is the maximum allowable minor radius of a fusion reactor, beyond which the power generated in the plasma will exceed allowable loadings of radiant energy or neutrons on the first wall. It is shown that if high beta (greater than 0.2) fusion reactors are feasible, the high reactivity of the DT reaction cannot be fully exploited because of wall loading limitations. In addition, some high beta reactors with advanced fuels are also found to be wall loading limited, and to have excess reactivity, which can be traded off for lower magnetic fields, longer particle containment times, etc.

34188 **Fusion-fission hybrids: environmental aspects and their role in hybrid rationale.** Holdren, J.P. (Univ. of California, Berkeley). Contract W-7405-ENG-48. *Journal of Fusion Energy ;* **1**: No. 2, 197-210(Apr 1981).

The rationale for developing hybrids depends on real or perceived liabilities of relying on pure fission to do the same job. Quite possibly the main constraint on expanded use of fission will be neither lack of fuel nor high costs, but perceived environmental liabilities - radioactive wastes, reactor safety, and links to nuclear weaponry. The environmental characteristics of hybrid systems and pure-fisson systems are compared here in detail. The findings are that significant environmental advantages for hybrids cannot now be demonstrated and may not exist. Therefore, if environmental drawbacks constrain the application of pure fission, hybrids probably also will be thus constrained.

34189 **OCLATOR: the one coil low aspect toroidal reactor.** Yoshikawa, S. (Princeton Univ., NJ). Contract EY-76-C-02-3073. *Journal of Fusion Energy ;* **1**: No. 2, 143-148(Apr 1981).

A new approach to construct a tokamak-type reactor(s) is presented here. Basically, the return conductors of toroidal field coils are eliminated and the toroidal field coil is replaced by one single large coil, around which will be placed several tokamaks or other toroidal devices. The elimination of return conductors should, in addition to other advantages, improve the accessibility and maintainability of the tokamaks, and offer a possible alternative to the search for special materials to withstand large neutron wall loading, as the frequency of changeover would be increased due to minimum downtime. It also makes it possible to have a low aspect ratio tokamak, which should improve the $\beta$ limit, so that a low toroidal magnetic field strength might be acceptable, meaning that NbTi superconducting wire could be used. This system is named OCLATOR (One Coil Low Aspect Toroidal Reactor).

34190 **Generating end plug potentials in tandem mirror plasma confinement by heating thermal particles so as to escape low density end stoppering plasmas.** Baldwin, D.E.; Logan, B.G. (to Department of Energy). US Patent 4,252,608. 24 Feb 1981. Filed date 16 Mar 1979. vp.

The invention provides a method and apparatus for raising the potential of a magnetic mirror cell by pumping charged particles of the opposite sign of the potential desired out of the mirror cell through excitation, with the pumping being done by an externally imposed field at the bounce frequency of the above charged particles. These pumped simple mirror cells then provide end stoppering for a center mirror cell for the tandem mirror plasma confinement apparatus. For the substantially complete pumping case, the end plugs of a tandem mirror can be up to two orders of magnitude lower in density for confining a given center mirror cell plasma than in the case of end plugs without pumping. As a result the decrease in recirculating power required to keep the system going, the technological state of the art required, and the capital cost are all greatly lowered.

**34191 Radiation source.** Thode, L.E. (to Department of Energy). US Patent 4,252,607. 24 Feb 1981. Filed date 5 Feb 1979. vp.

A device and method for relativistic electron beam heating of a high-density plasma in a small localized region. A relativistic electron beam generator or accelerator produces a high-voltage electron beam which propagates along a vacuum drift tube and is modulated to initiate electron bunching within the beam. The beam is then directed through a low-density gas chamber which provides isolation between the vacuum modulator and the relativistic electron beam target. The relativistic beam is then applied to a high-density target plasma which typically comprises dt, dd, or similar thermonuclear gas at a density of 1017 to 1020 electrons per cubic centimeter. The target gas is ionized prior to application of the relativistic electron beam by means of a laser or other preionization source to form a plasma. Utilizing a relativistic electron beam with an individual particle energy exceeding 3 mev, classical scattering by relativistic electrons passing through isolation foils is negligible. As a result, relativistic streaming instabilities are initiated within the high-density target plasma causing the relativistic electron beam to efficiently deposit its energy into a small localized region of the high-density plasma target.

**34192 Crossed-field divertor for a plasma device.** Kerst, D.W.; Strait, E.J. (to Department of Energy). US Patent 4,252,609. 24 Feb 1981. Filed date 24 Nov 1978. vp.

A divertor for removal of unwanted materials from the interior of a magnetic plasma confinement device includes the division of the wall of the device into segments insulated from each other in order to apply an electric field having a component perpendicular to the confining magnetic field. The resulting crossed-field drift causes electrically charged particles to be removed from the outer part of the confinement chamber to a pumping chamber. This method moves the particles quickly past the saddle point in the poloidal magnetic field where they would otherwise tend to stall, and provides external control over the rate of removal by controlling the magnitude of the electric field.

# 99 GENERAL AND MISCELLANEOUS

## 9902 Mathematics And Computers

*REFER ALSO TO CITATION(S) 33048, 33050, 33051, 33384, 33495, 33685, 33783, 33846, 33929*

**34193 (LBL—12370) Efficient methods for calculating the success function of fixed-space replacement policies.** Olken, F. (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 30p. NTIS, PC A03/MF A01. Order Number DE81029847.

Thesis.

Efficient methods are discussed for calculating the success function of replacement policies used to manage very large fixed size caches. Such problems arise in studying the caching of files on disk. Earlier work by Coffman and Randell, and Mattson et al. A class of replacement policies is characterized which it is possible to evaluate the success function for a single cache size in time O(n*log(s)), where n is the number of memory references in the trace and s is the size of cache. An algorithm is constructed to evaluate the success function for the Least Recently Used replacement policy in time O(n*log(s)), for cache sizes smaller than s. This algorithm runs in bounded memory, O(s). It is also shown how to modify Bennett and Kruskal's algorithm to run in bounded space. The two algorithms have the same asymptotic running times (within a constant factor). Measured running times for the classic LRU algorithm, Bennett and Kruskal's algorithm, and the new algorithm are compared. The impace of variable size segments (files, rather than fixed size pages), and deletions on algorithms for calculating success functions is considered.

**34194 (ORNL/CSD—79) Estimation problems associated with the Weibull distribution.** Bowman, K.O.; Shenton, L.R. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 125p. NTIS, PC A06/MF A01. Order Number DE81030466.

Series in descending powers of the sample size are developed for the moments of the coefficient of variation v* for the Weibull distribution F(t) = 1 -exp[-(t/b)/sup c/]. A similar series for the moments of the estimator c* of the shape parameter c are derived from these. Comparisons are made with basic asymptotic assessments for the means and variances. From the first four moments, approximations are given to the distribution of v* and c*. In addition, an almost unbiased estimator of c is given when a sample is provided with the value of v*. Comments are given on the validity of the asymptotically normal assessments of the distributions.

**34195 (SAND—81-1007C) Preliminary report on a theory of authentication.** Simmons, G.J. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 11p. (CONF-811024—1). NTIS, PC A02/MF A01. Order Number DE81025838.

From National engineering consortium; Chicago, IL, USA (26 Oct 1981).

The purpose of authentication - or literally the fingerprinting - of digital messages is to make it possible to establish that a message originated with the purported transmitter and that it was not altered during transit. Perhaps the easiest way to understand authentication is to observe that the theories of authentication and of error detecting codes are mathematical duals. In both instances redundant information (to the data being communicated) is introduced by the transmitter and interpreted by the receiver to accomplish the desired function. The duality arises from the way in which the redundant information is used, in the one instance to impose as much structure as possible on the acceptable messages (codes) and in the other to conceal as much of the structure of the messages as possible (authenticators).

**34196 (UCID—19076) Some notes on operating-system principles.** Nessett, D.M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Jul 1981. Contract W-7405-ENG-48. 262p. NTIS, PC A12/MF A01. Order Number DE81030675.

Only a few short years ago the number of people interested in operating system structure was quite small. Computers were expensive and hence only a relatively small number of them existed, mostly in large institutions such as corporations, research laboratories, and universities. Since there were a small number of machines, there was a relatively small community of people interested in the support software which multiplexed their resources (i.e., operating systems). Today, however, the explosion of cheap microcomputers into the world has dramatically increased the number of people who wish to understand how operating systems work. This interest has been encouraged by a number of things, but the most basic is the desire of users to maintain their own operating systems. This stems directly from the economics of microcomputers, that is, if expensive outside maintenance must be obtained for their operating systems, the economic advantages of microcomputers essentially disappear. It is for the above reasons that these notes have been prepared. They are intended to present the basic concepts needed to understand what has been termed third generation operating systems. While many microcomputers do not possess operating systems sophisticated enough to be categorized as third generation, many others do. Furthermore, the concepts presented in these notes should aid those who wish to understand less sophisticated operating systems. It is my hope that they meet the needs of those who desire a better understanding of operating system principles.

**34197 (UCRL—85156-Rev.1) Quadrantal symmetry calculations for nonsymmetric half-plane filters.** Goodman, D.M. (Lawrence Livermore National Lab., CA (USA)). 3 Dec 1980. Contract W-7405-ENG-48. 5p. (CONF-801170—2). NTIS, PC A02/MF A01. Order Number DE81030071.

From 14. Asilomar conference on circuits, systems and computers; Pacific Grove, CA, USA (17 Nov 1980).

The conditions under which an all-pole, stable, nonsymmetric half-plane filter has a quadrantally-symmetric magnitude response are investigated. It is shown that quadrantal symmetry is obtained if and only if the denominator of the transfer function can be written as the product of two functions; the inverse z-transforms of these two functions have different regions of support and one of them must obey a symmetry condition. The usefulness of these conditions in filter design algorithms is discussed.

34198 **(UCRL—86581) Concerning technical means for dealing with aspects of the near-term information onslaught.** Wood, L. (Lawrence Livermore National Lab., CA (USA)). 1981. Contract W-7405-ENG-48. 19p. (CONF-8106155—1). NTIS, PC A02/MF A01. Order Number DE81030159.

From Conference on science and the information onslaught; Los Alamos, NM, USA (1 Jun 1981).

Predictions are given about the future capabilities of the electronics manufacturing industry to produce very-large-scale integrated circuit computers. Such computers would have three to six orders of magnitude more computing power than present systems. The implications of this increase are considered even in terms of implanted intelligence in humans. (GHT)

34199 **Problems associated with approximating distributions.** Shenton, L.R. (Univ. of Georgia, Athens); Bowman, K.O.; Lam, H.K. pp 20-29 of Proceedings of the Statistical Computing Section of the American Statistical Association. Washington, DC; American Statistical Association (1979).

The following particular points are discussed: the problem of the choice of model in approximating statistics such as the sample skewness ($\sqrt{b_1}$), kurtosis ($b_2$), mean deviation ($\omega$/sub n/'); model deficiencies such as failure to reproduce the correct range in the distribution of the statistic; and moment evaluation when Taylor series are involved. 2 figures, 15 tables.

34200 **Bivariate distributions with given marginals and fixed measures of dependence.** Johnson, M.E. (Los Alamos Scientific Lab., NM); Tenenbein, A. pp 261-263 of Proceedings of the Statistical Computing Section of the American Statistical Association. Washington, DC; American Statistical Association (1978).

In many simulation applications it is required to generate dependent pairs of continuous random variables for which there is limited information on the joint distribution. Because of the lack of data, it may be difficult to specify completely the joint distribution; however, it may be realistic to specify the marginal distributions and some measure of dependence between the random variables. The problem of constructing continuous bivariate distributions with specified marginals has been discussed in the literature, which is briefly reviewed. A general method of constructing a bivariate distribution has been proposed by Nataf [Comptes Rendus Acad. Sciences; 225: 42-43(1962)]. The present paper describes two procedures for constructing bivariate distributions whose marginal distributions and measure of dependence, as given by Kendall's tau or the grade correlation coefficient rho/sub s/, are specified. Both of these procedures are based on the general method. The procedures are called the WLC (weighted linear combination and the TVR (trivariate reduction). Both of these procedures are easily adaptable to simulation models, and contain members that attain the Frechet upper and lower bounds. This paper discusses specific results from both the WLC and TVR procedures for arbitrary choices of density function, and considers in more detail the cases of the normal, uniform, exponential, and double exponential distributions. Finally, the properties of the various joint distributions obtained are summarized, and the application of these techniques to simulation models is discussed. (RWR)

## 9903 Information Handling

*REFER ALSO TO CITATION(S) 32900, 32905, 32967, 33023, 33092*

34201 **(BNL-NCS—51364) Minutes of the fifth annual meeting of the panel on reference nuclear data.** Burrows, T.W.; Coyne, J.J.; Brenner, D.S. (eds.). (Brookhaven National Lab., Upton, NY (USA)). Apr 1981. Contract AC02-76CH00016. 60p. NTIS, PC A04/MF A01. Order Number DE81030204.

The minutes include: approval of agenda and minutes of the fourth meeting; elections; reactor physics data needs; fusion data needs; biomedical data needs; status of international and national cooperation; status and availability of data files; status of transfer of responsibilities from NDP to NNDC; status of publications; on-line data base systems; and summary of recommendations and actions. (GHT)

34202 **(UCRL—85749) Fact retrieval for the 1980s.** Hampel, V.E. (Lawrence Livermore National Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 39p. (CONF-810950—1). NTIS, PC A03/MF A01. Order Number DE81028424.

From Conference of the Advisory Group for Aerospace Research and Development-North Atlantic Treaty Organization; Munich, F.R. Germany (9 Sep 1981).

This report reviews prevailing methodologies of fact retrieval in science and technology and makes suprise-free projections for the decade to come: numeric databases are shown to overtake in size and number the large bibliographic collections. This is expected to lead toward more sophisticiated, interactive data analysis techniques with graphical display options. The availability of low-cost intelligent computer terminals, micro- and minicomputers, is shown to make aggregation and post-processing of retrieved information from different sources readily possible. This capability may come into conflict with legal constraints and is bound to affect the traditional marketing of information. It will lead to the extraction of higher forms of intelligence from text and data. The user community is seen to shift from expert information specialists, who act now as middlemen, to the end-users of information. This less experienced user community will challenge the ingenuity of system designers for self-guiding, adaptive, and yet more sophisticated man-machine interfaces. The merging of wide-band digital communication networks with computer technologies will make it possible to interconnect computers, information centers, word processors, and other peripherals, worldwide. Techniques of tabular and graphical fact retrieval are examined. The prospects of fact retrieval by voice, touch screens, and videotext are discussed. The potential of two unusual three-dimensional display techniques, the computer-generated time-resolved integral hologram and the projection of virtual data images into space, are discussed. Resulting problems are examined and some solutions given by example of experience with the integrated Technology Information System at the Lawrence Livermore National Laboratory.

34203 **(UCRL—86143) Identifier protection in a distributed operating system.** Nessett, D.M. (Lawrence Livermore National Lab., CA (USA)). 6 Jun 1981. Contract W-7405-ENG-48. 6p. (CONF-811020—1). NTIS, PC A02/MF A01. Order Number DE81025978.

From National electronics conference; Chicago, IL, USA (26 Oct 1981).

A scheme was recently presented to protect capabilities in a distributed operating system. This scheme uses public-key encryption to ensure that capabilities cannot be stolen in a form useful to the thief nor forged by an unauthorized process or user. Unfortunately, security and efficiency considerations make currently available public-key encryption techniques unattractive. This report focuses on the characteristics an identifier protection scheme must possess and on the use of secret-key encryption to provide identifier protection.

# CORPORATE INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the report title and the volume and abstract numbers. Report numbers, if applicable, are given in parentheses at the end of the entry.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

## A


**Acres American, Inc., Buffalo, NY**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 9. Design approaches: CAES, Appendix C. Major mechanical equipment. Final report, 6:33369 (EPRI-EM—1589(Vol.9)(App.C))
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 8. Design approaches: UPH. Final report, 6:33371 (EPRI-EM—1589(Vol.8))

**Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.**
Kinetics of NO/sub x/ formation during early stages of pulversized-coal combustion. Third quarterly report, 4 April 1981-30 June 1981, 6:32945 (DOE/PC/30295—3)

**Acurex Corp., Research Triangle Park, NC (USA)**
Survey of particulate emission macro- and micro-sampling and sizing methods and real-time monitoring and sizing methods, 6:33742 (DOE/FC/10193—T1)

**Aerochem Research Labs., Inc., Princeton, NJ (USA)**
Soot formation in synfuels. Second quarterly report, 1 January 1981-31 March 1981, 6:33083 (DOE/PC/30304—2)

**Aerojet Energy Conversion Co., Sacramento, CA (USA)**
Fluid-bed heat-exchanger optimization and bed materials selection. Final report, 6:33467 (DOE/ET/11343—T2)

**Aerojet Nuclear Co., Scoville, ID (USA)**
Management Oversight and Risk Tree - MORT, 6:33918 (DOE/ID/01375—T1)

**Aerospace Corp., El Segundo, CA (USA)**
Improved effectiveness of solar repowering in the utilities with high coal generation, 6:33140 (ATR—80(7873)-4)

**Aerospace Corp., Germantown, MD (USA)**
Energy technologies and the environment: environmental information handbook, 6:33839 (DOE/EP—0026)
Technology characterizations: environmental information handbook. Second edition, 6:33840 (DOE/EP—0028)

**Aerospace Corp., Los Angeles, CA (USA)**
Evaluation of active and passive near-millimeter-wave radiometric imaging techniques for detection of concealed objects, 6:33062 (SAND—81-1051)
Program-management plan with critical-path definition for combustion augmentation with thermionic energy conversion (CATEC), 6:33438 (DOE/NASA/1062—9)

**Air Products and Chemicals, Inc., Allentown, PA (USA)**
Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)
Cryogenic methane separation/catalytic hydrogasification process analysis. Quarterly report, 6:32811 (DOE/ET/10325—T11)

**Alabama Energy Management Board, Montgomery (USA)**
Opelika resource recovery project: report on the technological and economic evaluation, 6:33475 (DOE/CS/20243—1)

**American Society of Mechanical Engineers, New York**
Study of non-Darcy natural convection from a vertical heated surface in a saturated porous medium, 6:33963 (PNL-SA—9712)

**Ames Lab., IA (USA)**
Application of ICP-AES to the multi-elemental and multi-isotopic analysis of fuel dissolver solutions. Progress report, 6:33059 (IS-M—337)
Automated on-line determination of PPB levels of sodium and potassium in low-Btu coal gas and fluidized bed combustor exhaust by atomic emission spectrometry, 6:32861 (IS-M—330)
Effect of applied stress on the transformation behavior of Ni-Ti, 6:33518 (IS-M—338)
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
Liquid-liquid chromatography fractionation of organic compounds in complex mixtures: application to automobile exhaust, 6:33575 (IS-T—914)
Mechanical properties and hydrogen embrittlement of scandium, 6:33519 (IS-T—918)
Some thermoelectric properties of the light rare earth sesquiselenides ($R_2Se$/sub 3-x/), 6:33559 (IS-M—329)
Superconductivity in Th-Nb composites, 6:33520 (IS-T—926)
Transwall: a modular visually transmitting thermal storage wall. Status report, 6:33169 (IS-M—345)
Transwall research, 6:33168 (IS-M—334)

**Amon Cherrywood Farms, Williamsburg, MI (USA)**
Project demonstration of wind-turbine electricity: interconnecting a northern Michigan fruit farm with a major utility, 6:33242 (DOE/R5/10226—1)

**Anaconda Corp., Denver, CO (USA)**
Geochemical exploration for uranium in the Red Desert, Wyoming, 6:33001 (GJBX—125(81))

**Applied Decision Analysis, Inc., Menlo Park, CA (USA)**
Evaluating R and D options under uncertainty. Volume 1. Pulverized-coal development strategies. Final report, 6:33424 (EPRI-EA—1964(Vol.1))
Evaluating R and D options under uncertainty. Volume 2. Atmospheric fluidized-bed combustion commercialization strategies. Final report, 6:33425 (EPRI-EA—1964-Vol.2)
Evaluating R and D options under uncertainty. Volume 3. An electric-utility generation-expansion planning model. Final report, 6:33426 (EPRI-EA—1964(Vol.3))

**Argonne National Lab., IL (USA)**
Advanced system experimental facility: solid waste to methane gas. Background and process description, 6:33079 (ANL/CNSV—22)
Assessment of coal-using, combined-cycle, heat-engine options for residential/commercial total and integrated energy systems, 6:33252 (ANL/FE—81-55)
Calcium/metal sulfide battery development program. Progress report, October 1979-September 1980, 6:33376 (ANL—81-14)
Effect of mechanical cleaning on seawater corrosion of candidate OTEC heat exchanger materials. Part 2. Tests with Amertap sponge rubber balls, 6:33149 (ANL/OTEC-BCM—018)
LMFBR fuel-design environment for endurance testing, primarily of oxide fuel elements with local faults, 6:33303 (CONF-8008111—1)
Materials technology for coal-conversion processes. Progress report, January-March, 1981, 6:32804 (ANL—81-30)
Performance predictions of passive solar commercial buildings, 6:33161 (CONF-811034—1)
Proceedings: conference on the economics of mined-land reclamation, 6:32880 (ANL/LRP-TM—20)

Studies of the regeneration of activated bauxite used as granular sorbent for the control of alkali vapors from hot flue gas of coal combustion, 6:33269 (ANL/CEN/FE—81-1)
TCLUST1: a computer program for analysis of intersubassembly heat transfer in an LMFBR, 6:33301 (ANL—81-18)
Transwall: a modular visually transmitting thermal storage wall. Status report, 6:33169 (IS-M—345)

**Arizona Solar Energy Research Commission, Phoenix (USA)**
Guidebook for solar process-heat applications, 6:33167 (DOE/TIC—1027977)

**Arkansas Univ., Fayetteville (USA)**
Mississippi County Community College Solar Photovoltaic Project. Final report, 6:33124 (DOE/ET/20347—T1)

**Army Cold Regions Research and Engineering Lab., Hanover, NH (USA)**
Effects of ice on coal movement via the inland waterways. Special report 81-13, 6:33404 (DOE/ET/14356—T1)

**Associated Universities, Inc., Washington, DC (USA)**
Experimental determination of anomalous scattering lengths of samarium for thermal neutrons, 6:34018 (BNL—29949)

**Auburn Univ., AL (USA). Dept. of Chemical Engineering**
Opelika resource recovery project: report on the technological and economic evaluation, 6:33475 (DOE/CS/20243—1)

**Auburn Univ., AL (USA). Engineering Experiment Station**
Conductor fatigue-life research. Final report, 6:33278 (EPRI-EL—1946)

**Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.**
Availability of solar energy reports from the National Solar Data Program, 6:33092 (SOLAR/0020—81/44)
Solar energy system performance evaluation: Aratex Services, Fresno, California, December 1979-November 1980, 6:33190 (SOLAR/2008—81/14)
Solar energy system performance evaluation: Cathedral Square, Burlington, Vermont, January 1980-December 1980, 6:33189 (SOLAR/1060—81/14)
Solar energy system performance evaluation: Forest City Dillon, Washington, DC, January 1980-December 1980, 6:33187 (SOLAR/1041—81/14)
Solar energy system performance evaluation: Montecito Pines, Santa Rosa, California, November 1979-April 1980, 6:33188 (SOLAR/1045—80/14)

**Avco-Everett Research Lab., Inc., Everett, MA (USA)**
Conceptual design study of potential early commercial MHD powerplant. Final report of Task 2 results, 6:33435 (DOE/NASA/0051—2)
XeF pump laser. Final technical report, 6:33649 (UCRL—15348)

**AVRADCOM Research and Technology Labs., Cleveland, OH (USA)**
Cold-air performance of compressor-drive turbine of Department of Energy upgraded automobile gas turbine engine. I. Volute-manifold and stator performance, 6:33486 (DOE/NASA/1011—34)

**Ayers (Emory) Associates, Inc., New York (USA)**
Analysis of the labor productivity decline in the U.S. bituminous coal mining industry. Final technical report , 6:32906 (DOE/ET/10033—T2)

## B

**Babcock and Wilcox Co., Alliance, OH (USA). Research Center**
Measurement of fundamental properties characterizing coal minerals and fireside deposits. First quarterly technical progress report, 1 April 1981-30 June 1981, 6:32859 (DOE/PC/40266—1)

**Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Generation Div.**
Factors affecting post-DNB operation for light water reactors. Final report, 6:33352 (EPRI-NP—1999(Vol.2))

**Babcock and Wilcox Co., New York (USA)**
In-vessel inspection before head removal: TMI II: Phase I. (Conceptual development), 6:33353 (GEND—010-Vol.1)

**Baker (Michael), Jr., Inc., Beaver, PA (USA)**
Coal waste artificial reef program, Phase 3. Volume 3. Engineering-economic evaluation of fixed coal waste block production and disposal. Final report, 6:32870 (EPRI-CS—2009(Vol.3))
Monitoring the fixed FGD sludge landfill, Conesville, Ohio. Phase II, 6:32869 (EPRI-CS—1984)

**Barry (Theodore) and Associates, Los Angeles, CA (USA)**
Study of photovoltaic cost elements. Volume 1. Executive report. Volume 2. Project background. Final report, 6:33136 (SAND—81-7014/Vol.1-2)
Study of photovoltaic cost elements. Volume 4. Installation cost model for residential PV systems: users manual. Final report, 6:33138 (SAND—81-7014/Vol.4)
Study of photovoltaic cost elements. Volume 5. Installation cost model for intermediate PV systems: users manual. Final report, 6:33139 (SAND—81-7014/Vol.5)
Study of photovoltaic cost elements. Volume 3. Sandia National Laboratories photovoltaic systems design catalog. Final report, 6:33137 (SAND—81-7014/Vol.3)

**Battelle Columbus Labs., OH (USA)**
CaO interactions in the staged combustion of coal. Third quarterly technical progress report, April 1, 1981-June 30, 1981, 6:32946 (DOE/PC/30301—3)
Measurement of outdoor noise levels adjacent to K-25 facility, ORGDP, 6:33046 (K/SUB—13876-81/1)

**Battelle Human Affairs Research Center, Seattle, WA (USA)**
Public perceptions of industrial risks: the context of public attitudes toward radioactive waste, 6:33382 (PNL—3799)

**Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation**
Technical progress report for the quarter, 1 January-31 March 1981, 6:33039 (ONWI—9-81-2)

**Battelle Pacific Northwest Labs., Richland, WA (USA)**
Analysis of column tracer experiments by a stochastic-convective transport method, 6:33923 (PNL-SA—9478)
Bibliography of the seasonal thermal energy storage library, 6:33374 (PNL—3645)
Effects of oil-shale solid-waste disposal on water quality: current knowledge, information requirements, and research strategy, 6:32997 (PNL-SA—9792)
Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)
Fracturing of simulated high-level waste glass in canisters, 6:33041 (PNL—3948)
List of DOE radioisotope customers with summary of radioisotope shipments, FY 1980, 6:33068 (PNL—3839)
Photovoltaic product directory and buyers guide, 6:33135 (PNL—3853)
Reservoir stability studies, 6:33370 (PNL-SA—9782)
Stability of multilayer earthen barriers used to isolate mill tailings: geologic and geotechnological considerations, 6:33040 (PNL—3902)
Technique for planning and managing industrial growth from the air-quality standpoint, 6:33835 (PNL-SA—9419)
Techniques for geothermal liquid sampling and analysis, 6:33220 (PNL—3801)
Thermochemical production of liquids from biomass, 6:33115 (PNL-SA—9246)
United States Department of Energy thermal energy storage program, 6:33373 (DOE/RL/01830—T6)
Unsaturated moisture and radionuclide transport: laboratory analysis and modeling, 6:33804 (PNL—3616)

**Bechtel Corp., San Francisco, CA (USA)**
Evaluation of dry alkalis for removing sulfur dioxide from boiler flue gases. Final report, 6:33270 (EPRI-FP—207)

**Belgrade Univ. (Yugoslavia)**
Oxidation of formic acid and methanol on single crystal platinum electrodes, 6:33605 (BNL—29817)

**Bell Aerospace Textron, Buffalo, NY (USA)**
High-mass-flux coal gasifier. Final report, Phase III, 6:32812 (DOE/ET/14674—16)

**Bendix Corp., Kansas City, MO (USA)**
Automation of a specimen stage in an electron microprobe. Final report, 6:33696 (BDX—613-2668)
Drill geometries for miniature holes, 6:33628 (BDX—613-2623)
Stress relaxation of cellular silicone material: 1981, 6:33555 (BDX—613-2645)
Tooling for electrochemical deburring. Topical report, 6:33629 (BDX—613-2644)

**Bendix Field Engineering Corp., Grand Junction, CO (USA)**
Domestic utility attitudes toward foreign uranium supply, 6:33391 (GJBX—182(81))

Geochemical exploration for uranium in the Red Desert, Wyoming, 6:33001 (GJBX—125(81))
**Bettis Atomic Power Lab., West Mifflin, PA (USA)**
Comparisons of turbulent-flow calculations with experiment, 6:33653 (WAPD-TM—1473)
**Black and Veatch Consulting Engineers, Kansas City, MO (USA)**
5-Megawatt solar-thermal test facility, 6:33141 (CONF-7508108—1)
**Boeing Co., Seattle, WA (USA). Boeing Engineering and Construction Div.**
Feasibility and economic study of medium-Btu coal gas blended with high-Btu by-product gas as an industrial energy source at Billings, Montana. Final report, 6:33082 (DOE/FE/20219—2)
**Bolt, Beranek and Newman, Inc., Cambridge, MA (USA)**
Evaluation of proposed control room improvements through analysis of critical operator decisions. Final report, 6:33333 (EPRI-NP—1982)
**Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)**
Information for decisionmakers. Energy conservation in industry and Department of Energy facilities, 6:33444 (CONF-7803136—)
**Booz, Allen and Hamilton, Inc., Bethesda, MD (USA). Transportation Consulting Div.**
Evaluation of the alternatives for contingency fuels in the commercial marine-transportation industry, 6:33462 (DOE/CS/51175—T18)
**Boston Coll., Weston, MA (USA). Weston Observatory**
Exploration of coal and anthracitic carbonaceous shale resources, Narragansett Basin, Massachusetts and Rhode Island. Final report, 1 October 1979-30 April 1981, 6:32899 (DOE/RA/20029—T1)
**Boyce Engineering International, Inc., Houston, TX (USA)**
External combustion steam injected gas turbine for cogeneration. Final report, 6:33254 (DOE/ET/11448—T1)
**British Columbia Univ., Vancouver (Canada). TRIUMF Facility**
Low temperature diffusion of positive muons in copper, 6:33957 (LA-UR—81-2473)
**Bronx Community Coll., New York (USA)**
Crystal structure and stoichiometry of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6$O/sub 2-1/2x/ system, 6:33591 (PNL-SA—9377)
**Brookhaven National Lab., Upton, NY (USA)**
Analysis of cooldown performance for ISABELLE helium refrigerator, 6:33681 (BNL—30009)
Analysis of gasoline supply for the United States during the 1979 shortage, 6:33398 (BNL—51330)
Angular-correlation and coincidence studies of excited $0^+$ and other levels in the transitional Ce nuclides $^{142}$Ce, $^{144}$Ce, $^{146}$Ce and $^{148}$Ce, 6:34017 (BNL—29690)
APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste, 6:33318 (BNL—29899)
Application of an LP model to strategic planning of multinational cooperative RD and D programs, 6:33387 (BNL—29857)
Applications of bent cylindrical mirrors to x-ray beamlines, 6:33687 (BNL—29940)
Comparative thermal performance of direct gain, Trombe, and sunspace walls, 6:33158 (BNL—29970)
Comparison of hydrostatic extrusion versus wire drawing as a method of producing $Nb_3Sn$ superconducting wire, 6:33499 (BNL—29941)
Cryopumping of hydrogen and helium, 6:33630 (BNL—30012)
Cycle design for the ISABELLE helium refrigerator, 6:33679 (BNL—30006)
Design of 24.8-kW, 3.8 K cryogenic system for ISABELLE, 6:33684 (BNL—30013)
Energy future: a primer for secondary school teachers, 6:33483 (BNL—51381)
Experimental determination of anomalous scattering lengths of samarium for thermal neutrons, 6:34018 (BNL—29949)
Fine-grained hodoscopes based on scintillating optical fibers, 6:33686 (BNL—29923)
Flame-retention head burner efficiency test results and analysis. Space-heating-equipment test program, 6:33446 (BNL—51321)
Heat-load measurement of prototype cryogenic magnets and leads for the ISABELLE project, 6:33682 (BNL—30010)
Hydride chemical compressor. Phase I, final report, 6:33631 (BNL—51369)
Interaction of stress with the martensitic phase transition in A15 compounds, 6:33500 (BNL—30016)
Investigation of the zinc electrode reaction. Annual report, October 1, 1979-September 30, 1980, 6:33377 (BNL—51370)
MAGCOOL: the production cooling facility for ISABELLE magnets, 6:33683 (BNL—30011)
MAP3S/RAINE emissions inventory. Progress report, December 1980, 6:33725 (BNL—51378)
Microbial transformation of low-level radioactive waste, 6:33795 (BNL—29762)
Minutes of the fifth annual meeting of the panel on reference nuclear data, 6:34201 (BNL-NCS—51364)
Multiparticle magnetic spectrometer with dE/dx and TRD particle identification, 6:33669 (BNL—29990)
Neutron capture cross section standards for BNL 325, Fourth Edition, 6:34039 (BNL-NCS—51388)
Neutron scattering studies of quasi one- and two-dimensional hydrogen-bonded ferroelectrics, 6:34037 (BNL—30004)
Ni elemental neutron induced reaction cross-section evaluation, 6:34038 (BNL-NCS—51346)
Numerical studies of gauge field theories, 6:33987 (BNL—29840)
Oxidation of formic acid and methanol on single crystal platinum electrodes, 6:33605 (BNL—29817)
Phase transitions and variant actions in lattice gauge theory, 6:33986 (BNL—29823)
Plans for Brookhaven Fastbus during the next $\pi \times 10^{16}$ nanoseconds, 6:33688 (BNL—30031)
Polarizing multilayer spectrometer for neutrons, 6:34036 (BNL—29922)
Process models for industry, 6:33464 (BNL—29880)
Production and use of high-grade silicon-diode temperature sensors, 6:33678 (BNL—30005)
QCD, OZI, and evidence for glueballs, 6:33985 (BNL—29768)
Real time coarse particle mass measurements in a high temperature and pressure coal gasifier process treatment, 6:32805 (BNL—22952)
Real-time coarse-particle mass measurements in a high-temperature/pressure coal-gasifier process treatment, 6:32806 (BNL—29953)
Search for the violation of time-reversal invariance in K/sub $\mu$3/ decays, 6:33965 (BNL—30026)
Slow positrons in the study of surface and near-surface defects, 6:33953 (BNL—29798)
Soft phonons and magnetic ordering in the $\gamma$-phase transition metal alloys Fe/sub 1-x/Pd/sub x/, 6:34043 (BNL—30037)
Solid-waste impacts of increased coal utilization, 6:32865 (BNL—24786)
Superconducting current densities in bronze-processed $Nb_3Sn$ multifilamentary wires, 6:33501 (BNL—30018)
Superconducting properties of $(Nb,Ti)_3Sn$ wires fabricated by the bronze process, 6:33502 (BNL—30019)
Thermal conductivity measurements of insulators for fusion blankets, 6:33498 (BNL—29779)
Transformation of Haemophilus influenzae by recombinant molecules, 6:33858 (BNL—29733)
Transient response of a thermal buffer: a study for ISABELLE, 6:33680 (BNL—30008)
Water analysis methods at the integrated Lake Watershed Acidification Study Laboratory, Raquette Lake, NY, 6:33809 (BNL—51396)
**Brookhaven National Lab., Upton, NY (USA). National Center for Analysis of Energy Systems**
Assessment methodology for the air quality impact of residential wood burning, 6:33445 (BNL—29763)
Comparative economic performance of selected passive solar heating and cooling technologies, 6:33159 (BNL—51394)
Impacts of Federal clean air law on district-heating opportunities, 6:33770 (BNL—51389)
**Brown Univ., Providence, RI (USA). Div. of Engineering**
Flow in geothermal wells. Part IV. Transition criteria for two-phase flow patterns, 6:33226 (DOE/ET/27225—9)
**Burbank City Public Service Dept., CA (USA)**
Selective load control for industrial customers, 6:33264 (ORNL/Sub—7399/1)

## C

**California Energy Resources Conservation and Development Commission, Sacramento (USA)**
Geothermal resources development project: Phase I, 6:33205 (DOE/ET/27167—T1)

**California Inst. of Tech., Pasadena (USA)**
Application of ion cyclotron resonance spectroscopy, photoionization mass spectrometry and photoelectron spectroscopy to study the properties and reactions of ions in gases, 6:33588 (CALT—767P8-8)

**California Univ., Livermore (USA). Lawrence Livermore Lab.**
Engineering evaluation of Riola containment, 6:33719 (UCID—19164)
Preliminary design and analysis of aluminum-air cells providing for continuous feed and full utilization of anodes, 6:33380 (UCID—19178)
Some notes on operating-system principles, 6:34196 (UCID—19076)
Technical evaluation of the station and instrument ground grid systems at the Davis Besse Nuclear Power Station, Unit 1, 6:33299 (UCID—19105)

**Cardinal Management Associates, Inc., Los Angeles, CA (USA)**
Impact of motor gasoline price/availability trends on selected minority and disadvantaged populations, 6:32981 (DOE/MI/01006—T1-Pt.2)
Impact of motor-gasoline price/availability trends on selected minority and disadvantaged populations, 6:32980 (DOE/MI/01006—T1-Pt.1)

**Cardinal Management Associates, Inc., Washington, DC (USA)**
Impact of motor gasoline price/availability trends on selected minority and disadvantaged populations, 6:32981 (DOE/MI/01006—T1-Pt.2)
Impact of motor-gasoline price/availability trends on selected minority and disadvantaged populations, 6:32980 (DOE/MI/01006—T1-Pt.1)

**Carleton Univ., Ottawa, Ontario (Canada)**
Design and performance of the new cathode readout proportional chambers in LASS, 6:33690 (SLAC-PUB—2642)

**Catalytic, Inc., Wilsonville, AL (USA)**
Evaluation of liquid-phase prilling as a technique for SRC solidification, 6:32810 (DOE/ET/10154—T14)

**Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.**
Creep damage accumulation during thermal cycling of a transition joint, 6:33326 (R/M/R—207)
Finite element analysis of the stress intensity factors of cracks in welded transition joints, 6:33327 (R/M/R—263)
Interfacial structures in nickel-based transition joints after long term service, 6:33266 (RD/M/N—1131)
Measurement of strain across a transition joint interface using Moire fringes, 6:33325 (R/M/N—1068)
Thermal cycling behavior of a cracked transition joint between austenitic and ferritic steels welded with austenitic weld metal, 6:33328 (R/M/R—271)

**Charles County Community Coll., La Plata, MD (USA)**
Guide to Douglas Point, Charles County, Maryland, 6:33807 (DOE/SR/10018—5)

**Chicago Bridge and Iron Co., Houston, TX (USA)**
Evaluation of shielded metal arc and flux cored metal arc welding consumables for fabrication of stainless steel magnet cases for 4K service, 6:33640 (UCRL—85564)

**Cincinnati Univ., OH (USA). Dept. of Chemical and Nuclear Engineering**
REFUEL: a computer program for automated BWR fuel management. Final report, 6:33319 (EPRI-NP—1920)
Studies of transition boiling heat transfer with saturated water at 1-4 bar. Final report, 6:33349 (EPRI-NP—1899)

**Cities Service Co., Jackson, MS (USA)**
Bodcau in situ combustion project. Fourth annual report, September 1, 1979-February 28, 1981, 6:32969 (DOE/ET/12057—8)

**Cities Service Research and Development Co., Tulsa, OK (USA). Cities Service Technical Center**
Flash hydropyrolysis of Western Kentucky No. 9 bituminous coal with catalysts. Final technical progress report, 6:32818 (DOE/ET/14943—T1)

**City Coll., New York (USA)**
Multiparticle magnetic spectrometer with dE/dx and TRD particle identification, 6:33669 (BNL—29990)

**City Univ. of New York, NY (USA)**
Fine-grained hodoscopes based on scintillating optical fibers, 6:33686 (BNL—29923)

**Clark Univ., Worcester, MA (USA)**
Angular-correlation and coincidence studies of excited $0^+$ and other levels in the transitional Ce nuclides $^{142}Ce$, $^{144}Ce$, $^{146}Ce$ and $^{148}Ce$, 6:34017 (BNL—29690)

**Clemson Univ., SC (USA). Dept. of Forestry**
Growth and yield of loblolly, slash, and longleaf pines in the South Carolina Sandhills: third measurement. Final report, 6:33886 (DOE/SR/10706—1)

**Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering**
Enthalpy measurement of coal-derived liquids. Technical progress report, May-July 1981, 6:32860 (DOE/PC/40787—1)

**Colorado School of Mines, Golden (USA). Research Inst.**
Transportation and marketing plan, 6:32996 (DOE/SF/10852—T1)

**Colorado State Univ., Fort Collins (USA)**
Geochemical exploration for uranium in the Red Desert, Wyoming, 6:33001 (GJBX—125(81))

**Colorado Univ., Boulder (USA)**
Summary of the proceedings of the workshop on future directions in nuclear physics research, 6:33993 (DOE/ER/10472—1)

**Combustion Engineering, Inc., Windsor, CT (USA)**
Cofiring of refuse-derived fuel and coal at Oak Creek. Volume 1. Boiler corrosion evaluation. Final report, 6:33088 (EPRI-CS—1983-Vol.1)
Engineering study of frequent refueling for improved uranium utilization in pressurized water reactors, 6:33297 (PNL-SA—9641)
Factors affecting post-DNB operation for light water reactors. Final report , 6:33351 (EPRI-NP—1999(Vol.1))

**Combustion Engineering, Inc., Windsor, CT (USA). Advanced Development Dept.**
Conceptual design selection and development of a latent-heat thermal-energy-storage subsystem for a saturated-steam solar receiver and load, 6:33201 (SAND—81-8184)

**Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Applied Geomechanics**
Emphasis in overseas research on underground coal mining: geomechanical implications, 6:32904 (CSIRO—2)
Mathematical analysis of factors influencing the development of mining-induced fractures around blind-ended openings with particular reference to Leichhardt Colliery, 6:32858 (CSIRO—7)
Preliminary evaluation of two stress-analysis computer programs based on the displacement-discontinuity and finite-element methods, 6:32905 (CSIRO—3)

**Comstock and Wescott, Inc., Cambridge, MA (USA)**
Conceptual design selection and development of a latent-heat thermal-energy-storage subsystem for a saturated-steam solar receiver and load, 6:33201 (SAND—81-8184)

**Conoco, Inc., Stamford, CT (USA)**
Pipeline-gas demonstration plant: Phase I. Construction planning. Volume 1: safety procedures, temporary facilities, and labor survey, 6:32856 (DOE/ET/13060—T9(Vol.2))

**Consolidated Controls Corp., Bethel, CT (USA)**
Neutron-activation analysis of turbine deposits. Interim report, 6:33573 (EPRI-CS—1958)

**Consolidated Edison Co. of New York, Inc., New York (USA)**
Particulate emission characteristics of oil-fired urtility boilers, 6:32989 (EPRI-CS—1995)

**Cornell Univ., Geneva, NY (USA). Inst. of Food Science**
Handbook for energy conservation in food canning plants, 6:33465 (DOE/CS/40087—T1)

**Cornell Univ., Ithaca, NY (USA). Materials Science Center**
Direct experimental determination of the particle reflection coefficients of low-energy (100 to 1500 eV) $^3He$ and $^4He$ atoms from the (110) plane of tungsten, 6:33956 (DOE/ER/03158—93)

**Coury and Associates, Denver, CO (USA)**
Two-phase flow in geothermal energy sources. Final technical report, 6:33227 (DOE/ET/28359—T1)

## D

**Data Resources, Inc., Lexington, MA (USA)**
Models for forecasting energy use in the US farm sector. Final report, 6:33470 (EPRI-EA—1956(Vol.1))
Regional load-curve models: scenario and forecast using the DRI model. Final report, 6:33422 (EPRI-EA—1672(Vol.3))

**Delaware Univ., Newark (USA). Inst. of Energy Conversion**
Cadmium sulfide/copper sulfide heterojunction cell research by sputter deposition. Quarterly technical progress report, December 1, 1980-February 28, 1981, 6:33119 (SERI/PR—9296-T1)

**Denison Univ., Granville, OH (USA)**
Neutron cross section measurements using the ORELA: the stable tellurium isotopes (n,γ), $^{238}$U(n,n'), $^{232}$Th(n,n'), $^{187}$Os(n,n'), $^{186\ 187\ 188}$Os(n,nn'γ), and $^{205}$Tl(n,nγ). Progress report, September 1, 1980-September 1, 1981, 6:33991 (DOE/ER/02696—11)

**Denver Research Inst., CO (USA)**
Hydride chemical compressor. Phase I, final report, 6:33631 (BNL—51369)
Two-phase flow in geothermal energy sources. Final technical report, 6:33227 (DOE/ET/28359—T1)

**Department of Atomic Energy, Bombay (India)**
Proceedings of the interdisciplinary meeting on hydrogen in metals, 6:33503 (CONF-800280—)

**Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center**
Design properties of coal liquids: edited workshop proceedings, 6:32807 (CONF-810381—)
Heating oils, 1981, 6:32985 (DOE/BETC/PPS—81/4)
Motor gasolines, Winter 1980-81, 6:32988 (DOE/BETC/PPS—81/3)

**Department of Energy, Morgantown, WV (USA). Morgantown Energy Research Center**
Advanced-gasification processes, 6:32820 (DOE/METC/SP—183)
Surface Coal Gasification, 6:32819 (DOE/METC/SP—110)

**Department of Energy, Oak Ridge, TN (USA). Technical Information Center**
Contribution of Clinch River Breeder Reactor plant design and development to the LMFBR fuel cycle, 6:33302 (CONF-810941—1)

**Department of Energy, Pittsburgh, PA (USA). Pittsburgh Mining Technology Center**
Support selection for the multi-lift mining method, 6:32903 (CONF-810714—3)

**Department of Energy, Washington, DC (USA)**
Definitions of CAMAC terms, 6:33685 (DOE/ER—0104)
Program-management plan with critical-path definition for combustion augmentation with thermionic energy conversion (CATEC), 6:33438 (DOE/NASA/1062—9)
Technology of controlled nuclear fusion, 6:34075 (CONF-801011—(Vol.1))
Technology of controlled nuclear fusion, 6:34101 (CONF-801011—(Vol.2))
Technology of controlled nuclear fusion, 6:34138 (CONF-801011—(Vol.3))

**Department of Energy, Washington, DC (USA). Energy Information Administration**
National Interim Energy-Consumption Survey: exploring the variability in energy consumption, 6:33449 (DOE/EIA—0272)

**Department of the Air Force, Los Angeles, CA (USA)**
United States Department of Energy thermal energy storage program, 6:33373 (DOE/RL/01830—T6)

**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.**
Effects of high radiation doses on Linde Ion Siv IE-95, 6:33028 (DP-MS—81-18)
$^{238}$Pu fuel form processes. Quarterly report, October-December 1980, 6:33070 (DPST—80-128-4)
Recovery of americium-241 from aged plutonium metal, 6:33572 (DP—1577)
Tritium autoradiography, 6:33654 (DP-MS—81-12)
Workshop on seismic performance of underground facilities, 6:33029 (DPST—81-262)

**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant**
Environmental monitoring in the vicinity of the Savannah River Plant. Annual report, 1980, 6:33801 (DPSPU—81-30-1)

**Durban-Westville Univ. (South Africa)**
Experimental determination of anomalous scattering lengths of samarium for thermal neutrons, 6:34018 (BNL—29949)

## E

**EG and G Idaho, Inc., Idaho Falls (USA)**
Analysis of short-term reactor cavity transient, 6:33342 (CONF-810606—74)
In-vessel inspection before head removal: TMI II: Phase I. (Conceptual development), 6:33353 (GEND—010-Vol.1)
Janus displays for improved reactor plant operation and control, 6:33331 (CONF-810606—71)
Laboratory and field portable system for calibrating airborne multispectral scanners, 6:33697 (EGG—1183-1777)
Micro-hydropower in the United States, 6:33089 (EGG-M—02781)
Optimal calibration of nuclear instrumentation, 6:33332 (CONF-810606—72)
Posttest analysis of international standard problem 10 using RELAP4/MOD7, 6:33341 (CONF-810606—73)
Semiannual progress report for the Idaho Geothermal Program, October 1, 1980 to March 31, 1981, 6:33225 (EGG—2110)

**EG and G, Inc., Albuquerque, NM (USA)**
Performance testing of the TOLTEC TI-410 concentrating solar collector, 6:33195 (SAND—81-0369)

**Electric Power Research Inst., Palo Alto, CA (USA)**
Assessment of optimum aquatic microcosm design for pollution impact studies, 6:33821 (EPRI-EA—1989)
Workshop proceedings: world oil and natural gas supplies, 6:32982 (EPRI-WS—79-182)

**Electric Power Research Inst., Palo Alto, CA (USA). Fossil Fuel Power Plant Dept.**
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)

**Electric Power Research Inst., Palo Alto, CA (USA). Nuclear Power Div.**
Structural Mechanics Program: progress in 1980, 6:33289 (EPRI-NP—1969-SR)

**Encotech, Inc., Schenectady, NY (USA)**
Combustion turbine combined-cycle R and D project priority analysis. Final report, 6:33260 (EPRI-AP—1943)

**Energy and Environmental Analysis, Inc., Arlington, VA (USA)**
Potential environmental issues related to building energy performance standards, 6:33447 (DOE/CS/20205—T17)

**Energy and Environmental Research Corp., Santa Ana, CA (USA)**
Soot formation in synthetic fuel droplets. Third quarterly technical progress report, April 1 to June 30, 1981, 6:33743 (DOE/PC/30298—T3)

**Energy Research and Development Administration, Washington, DC (USA)**
Findings supporting determination related to international nuclear power export activities pending preparation of a section 102(2)(C) NEPA environmental statement, 6:33290 (ERDA—80)

**Energy Research and Development Administration, Washington, DC (USA). Div. of Geothermal Energy**
Geothermal Energy Research, Development and Demonstration Program. First annual report, 6:33204 (ERDA—77-9)

**Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.**
Variation in plant response to ozone: a conceptual model of physiological events, 6:33908 (CONF-8009172—1)

**Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.**
Offsite environmental monitoring report. Radiation monitoring around United States nuclear test areas, calendar year 1980, 6:33802 (EPA/600—4-81-047)

**Environmental Protection Agency, Washington, DC (USA). Office of Environmental Engineering and Technology**
Workshop on indoor air quality research needs, 6:33738 (CONF-801259—)

**ERGENICS, Wyckoff, NJ (USA)**
Hydride chemical compressor. Phase I, final report, 6:33631 (BNL—51369)
**ESB, Inc., Yardley, PA (USA). ESB Technology Center**
Sodium chloride battery development program for load leveling. Interim report, January 1, 1975-December 31, 1975, 6:33263 (EPRI-EM—230)
**Eureka Labs., Inc., Sacramento, CA (USA)**
Heating and cooling applications of atriums and attached greenhouses. A state-of-the-art report, 6:33166 (DOE/SF/11511—T1)
**Exxon Research and Engineering Co., Linden, NJ (USA)**
Thin-film polycrystalline-silicon solar cells. Quarterly report No. 1, January 1-March 31, 1979, 6:33107 (DOE/ET/23047—T2)

## F

**Federal Energy Administration, Washington, DC (USA)**
Technical reports of the Federal Energy Administration. Cumulative through June 30, 1977, 6:33381 (NTISUB/C—221-404)
**Florida Inst. of Tech., Melbourne (USA)**
Geographic distribution of the OTEC resource off the south and east coasts of the Florida Peninsula, 6:33150 (DOE/ER/05518—1)
**Florida State Univ., Tallahassee (USA). Dept. of Physics**
Progress report, October 1, 1980-June 30, 1981, 6:33966 (DOE/ER/03509—T1)
**Flow Resources Corp., McLean, VA (USA)**
Evaluation of CHESS: New York asthma data 1971 to 1972. Volume 2, 6:33910 (EPRI-EA—1994(Vol.2))
**Fluidised Combustion Contractors Ltd., East Grinstead, Sussex (UK)**
Studies of in-bed corrosion in a pressurized fluidized-bed combustor. Final report, 6:33660 (EPRI-CS—1935)
**Fluor Engineers and Constructors, Inc., Irvine, CA (USA)**
Entrained gasification combined-cycle control study. Volume 2. Results. Final report, 6:33255 (EPRI-AP—1422-Vol.2)
Entrained gasification combined-cycle control study. Volume 3: model descriptions. Final report, 6:33256 (EPRI-AP—1422-Vol.3)
**Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)**
Engineering assessment of inactive uranium mill tailings, Naturita Site, Naturita, Colorado, 6:33024 (DOE/UMT—012)
Engineering assessment of inactive uranium mill tailings, Shiprock site, Shiprock, New Mexico, 6:33026 (DOE/UMT—0104)
Summary of the engineering assessment of inactive uranium mill tailings, Naturita site, Naturita, Colorado, 6:33025 (DOE/UMT—012S)
Summary of the engineering assessment of inactive uranium mill tailings, Shiprock Site, Shiprock, New Mexico, 6:33027 (DOE/UMT—0104S)
**Foster Wheeler Energy Corp., Livingston, NJ (USA)**
Pipeline-gas demonstration plant: Phase I. Construction planning. Volume 1: safety procedures, temporary facilities, and labor survey, 6:32856 (DOE/ET/13060—T9(Vol.2))

## G

**General Accounting Office, Washington, DC (USA)**
Federal electrical-emergency preparedness is inadequate, 6:33420 (EMD—81-50)
Minerals management at the Department of the Interior needs coordination and organization, 6:33385 (EMD—81-53)
**General Atomic Co., San Diego, CA (USA)**
Algorithms developed to obtain particular numerical solutions to the ideal MHD equilibrium problem, 6:34058 (GA-A—16400)
Current driven nonideal instability in a force-free toroidal plasma, 6:34059 (GA-A—16418)
GATO: an MHD stability code for axisymmetric plasmas with internal separatrices, 6:34060 (GA-A—16441)
Performance of TiC-coated graphite in electron-beam tests and Doublet III operation, 6:34172 (GA-A—16384)
**General Electric Co., Cincinnati, OH (USA)**
Storage requirement definition study. final report, 6:33143 (NASA-CR—163882)
**General Electric Co., Cincinnati, OH (USA). Advanced Energy Programs Dept.**
Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 1. Executive summary, 6:33484 (DOE/CS/54224—T1-Vol.1)
Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 2. Final technical report, 6:33485 (DOE/CS/54224—T1-Vol.2)
**General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.**
Integrated residential photovoltaic array development. Quarterly report No. 2, 6:33125 (DOE/JPL/955894—2)
**General Electric Co., San Jose, CA (USA). Nuclear Energy Div.**
8 x 8 fuel surveillance program: pre-irradiation characterization, Monticello fuel assembly, December 1974, 6:33291 (DOE/ET/34031—1)
8 x 8 fuel surveillance program at Monticello - end of Cycle 3: first post-irradiation measurements, January 1975, 6:33292 (DOE/ET/34031—2)
8 x 8 fuel surveillance program at Monticello site - end of Cycle 4: second post-irradiation inspection, September 1975, 6:33293 (DOE/ET/34031—3)
8 x 8 fuel surveillance program at Monticello site - end of Cycle 5: third post-irradiation inspection, September 1977, 6:33294 (DOE/ET/34031—4)
8 x 8 fuel surveillance program at Monticello site - end of Cycle 6: fourth post-irradiation inspection, October 1978, 6:33295 (DOE/ET/34031—5)
**General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.**
Engineering approach for elastic-plastic fracture analysis, 6:33510 (EPRI-NP—1931)
**General Electric Co., Schenectady, NY (USA). Gas Turbine Div.**
Water-cooled gas turbine development program. Final report, 6:33257 (EPRI-AP—1889(Vol.1))
Water-cooled gas turbine development program. Final report, 6:33258 (EPRI-AP—1889-Vol.2)
**General Electric Co., Schenectady, NY (USA). Research and Development Center**
Partial discharge inception and extinction studies in polymer film structures impregnated with compressed $SF_6$ gas, 6:33276 (CONF-811016—2)
**General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.**
Aging of Adiprene L-100/butanediol/trimethylolpropane stocks, 6:33069 (GEPP-TIS—587)
**General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.**
High temperature chemomechanical interactions between alkali metals and urania-base oxide reactor fuels, 6:33308 (GEFR-SP—236)
Sodium boiling and mixed oxide fuel thermal behavior in FBR undercooling transients; W-1 SLSF experiment results, 6:33354 (HEDL-SA—2263-FP)
**General Motors Technical Center, Warren, MI (USA)**
Second generation heliostat. Volume II. Definition of a heliostat manufacturing facility. Final report, 6:33198 (SAND—81-8177-Vol.2)
**Georgia Inst. of Tech., Atlanta (USA)**
5-Megawatt solar-thermal test facility, 6:33141 (CONF-7508108—1)
**GeoTrans, Inc., Herndon, VA (USA)**
Review of simulation techniques for aquifer thermal energy storage (ATES), 6:33375 (PNL—3769)
**Glowny Inst. Gornictwa, Katowice (Poland)**
Method of investigations, estimation, and classification of roofs in mines in the United States of America for the selection of suitable mechanized support for longwalls. Report No. 1: January 1, 1977-March 31, 1977, 6:32910 (DOE/TIC—11477)
Removal and recovery of fine size coal from coal preparation plant waters. Report No. 1: January 1, 1977-December 31, 1977, 6:32924 (DOE/TIC—11482)
Subsidence prediction and control. Phase I. The state of knowledge in Poland concerning the influence of mining

exploitation on the surface. Final report, 6:32911 (DOE/TIC—11481)

**Gordian Associates, Inc., Hackensack, NJ (USA)**
Generation planning system: methodology and case study. Final report, 6:33423 (EPRI-EA—1807)

**Grumman Aerospace Corp., Princeton, NJ (USA)**
Axisymmetric stability of vertically asymmetric tokamaks at large beta poloidal, 6:34069 (PPPL—1831)

**Gruy Federal, Inc., Arlington, VA (USA)**
Multi-task support to the Division of Geothermal Energy's hydrothermal resources program. Final report, 6:33206 (DOE/EV/10072—5)

**Gulf Coast Research Lab., Ocean Springs, MS (USA)**
Studies on toxicity of OTEC plant components on marine animals from the Gulf of Mexico. Final report, September 1, 1978-November 30, 1980, 6:33909 (DOE/ET/20512—T1)

**Gulf Research and Development Co., Pittsburgh, PA (USA)**
Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Annual progress report, February 1980-February 1981, 6:32834 (DOE/PC/30080—4)

**Gulf Science and Technology Co., Pittsburgh, PA (USA). Chemical and Minerals Div.**
Effects of components of synfuels on soot formation. Quarterly technical progress report Number 3, April 1-June 30, 1981, 6:32947 (DOE/PC/30307—3)

**Gulf Universities Research Consortium, Bellaire, TX (USA)**
Relational methodology for integrating and analyzing field test and research data describing enhanced oil recovery, 6:32967 (DOE/ET/10145—72)

## H

**Hanford Engineering Development Lab., Richland, WA (USA)**
Analysis of in-core coolant temperatures of FFTF instrumented fuels tests at full power, 6:33337 (HEDL-SA—2330-Rev.1)
Automated remote positioning and examination of FFTF reactor power characterization dosimeters, 6:33336 (HEDL-SA—2312-FP)
Comparison of the swelling and the microstructural/microchemical evolution of AISI 316 irradiated in EBR-II and HFIR, 6:33516 (HEDL-SA—2359)
Damage development and hardening in 14 MeV neutron irradiation of copper alloys at 25°C, 6:33515 (HEDL-SA—2357)
Effects of transmutation products on swelling in 316 stainless steel, 6:33514 (HEDL-SA—2342-FP)
Evaluation of high-pressure containment buildings for LMFBR's, 6:33359 (HEDL-SA—2292-FP)
Fuel pin behavior under slow overpower transient conditions; HEDL W-2 SLSF experiment results, 6:33357 (HEDL-SA—2284-FP)
Heat transfer in a fuel pin shipping container, 6:33635 (HEDL-SA—2201-FP)
High rate transient mechanical properties of unirradiated fast reactor cladding, 6:33358 (HEDL-SA—2288-S)
Instrumented in-reactor test capabilities in FFTF, 6:34174 (HEDL-SA—2476-FP)
Internal fuel motion as an inherent shutdown mechanism for LMFBR accidents: PINEX-3, PINEX-2, and HUT 5-2A experiments, 6:33355 (HEDL-SA—2264-FP)
Microstructural examination of several commercial ferritic alloys irradiated to high fluence, 6:33512 (HEDL-SA—2338-FP)
Miniaturized fatigue crack growth specimen technology and results, 6:33517 (HEDL-SA—2475)
Neutron environment in d + Li facilities, 6:34173 (HEDL-SA—2340FP)
Notch tensile behavior of irradiated 20% cold-worked Type 316 stainless steel, 6:33511 (HEDL-SA—2317)
Sodium boiling and mixed oxide fuel thermal behavior in FBR undercooling transients; W-1 SLSF experiment results, 6:33354 (HEDL-SA—2263-FP)
Startup of the FFTF sodium cooled reactor, 6:33310 (HEDL-SA—2371)
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
Technique for preparation of prototypic fast test reactor mixed-oxide fuel pins for ceramography and metallography, 6:33309 (HEDL-SA—2333-FP)
Transient redistribution of intragranular fission gas in irradiated mixed oxide, 6:33356 (HEDL-SA—2272)
Utilizing FFTF: the keystone for breeder development, 6:33311 (HEDL-SA—2386)

**Harvard Medical School, Boston, MA (USA). Brigham and Women's Hospital**
Myocardial perfusion scintigraphy using a new technique, the mesh chamber. Progress report, September 1, 1978-May 1, 1981, 6:33689 (DOE/EV/04969—3)

**High Life Helicopters, Inc., Puyallup, WA (USA)**
Airborne gamma-ray spectrometer and magnetometer survey: Peoria, Decater, Belleville Quadrangles, (IL). Final report, 6:33005 (GJBX—241-81-Vol.1)

**Honeywell, Inc., Minneapolis, MN (USA)**
5-Megawatt solar-thermal test facility, 6:33141 (CONF-7508108—1)

**Houston Univ., TX (USA)**
Two-phase flow in geothermal energy sources. Final technical report, 6:33227 (DOE/ET/28359—T1)

**Hydrogen Consultants, Inc., Denver, CO (USA)**
Hydride chemical compressor. Phase I, final report, 6:33631 (BNL—51369)

## I

**Iceland Univ., Reykjavik**
Progress report on research on human genetics in Iceland, 6:33859 (DOE/EV/03214—T3)

**Illinois Univ., Urbana (USA)**
Devitrification kinetics of cadmium-germanium-arsenide glasses, 6:33558 (DOE/ER/01198—1367)
Phonons in graphite intercalation compounds measured by neutron scattering, 6:33557 (DOE/ER/01198—1354)

**Illinois Univ., Urbana (USA). Dept. of Civil Engineering**
Treatment of coal-conversion wastewater with the powdered activated carbon-contact-stabilization activated-sludge process. First annual technical progress report, February 1, 1981-July 31, 1981, 6:32867 (DOE/PC/30233—T2)

**Indiana Laborers' Training Trust Fund, Bedford (USA)**
Midwest appropriate technology small grants program. Semi-annual technical progress report, 6:33194 (DOE/R5/10223—2)

**Indianapolis Center for Advanced Research, IN (USA)**
Demonstration of waste-sludge incinerator fuel reduction: pilot project report, 6:33476 (DOE/CS/20321—1)

**Inhalation Toxicology Research Inst., Albuquerque, NM (USA)**
Low-Btu-gasifier emissions toxicology. Status report, December 1980, 6:32960 (LMF—85)

**Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)**
Phonons in graphite intercalation compounds measured by neutron scattering, 6:33557 (DOE/ER/01198—1354)

**INTERA Environmental Consultants, Inc., Houston, TX (USA)**
Review of simulation techniques for aquifer thermal energy storage (ATES), 6:33375 (PNL—3769)

**International Coal Refining Co., Allentown, PA (USA)**
SRC-I quarterly technical report, January-March 1981, 6:32821 (DOE/OR/03054—3)

**International Energy Agency, 75 - Paris (France)**
Optimization of solar heating and cooling systems, 6:33184 (NP—1903997)

**International Research and Technology Corp., McLean, VA (USA)**
Proceedings: workshop on cycling and effects of toxic substances, Carmel, California, October 26-29, 1980, 6:33794 (EPRI-EA—1988)

**Interstate Electronics Corp., Anaheim, CA (USA)**
Ocean thermal energy conversion programmatic environmental analysis, 6:33152 (LBL—10511-Vol.1)

**Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Architecture**
Transwall: a modular visually transmitting thermal storage wall. Status report, 6:33169 (IS-M—345)

## J

**Jet Propulsion Lab., Pasadena, CA (USA)**
Bias-humidity testing of solar-cell modules, 6:33108 (DOE/JPL—1012-78/11)
Development of simplified process for environmentally resistant cells. Final report, 8 Jun. 1978 - 30 Nov. 1980, 6:33144 (NASA-CR—163884)
Dish Stirling solar receiver program. Final report, 6:33145 (NASA-CR—163889)
Storage requirement definition study. final report, 6:33143 (NASA-CR—163882)

## K

**Kayex Corp., Rochester, NY (USA)**
Development of advanced Czochralski growth process to produce low-cost 150-kG silicon ingots from a single crucible for technology readiness. Second quarterly progress report, January 1-March 31, 1981, 6:33112 (DOE/JPL/955733—T1)
**Kent State Univ., OH (USA). Dept. of Geology**
Peat deposits of Dismal Swamp pocosins: Camden, Currituck, Gates, Pasquotank, and Perquimans Counties, North Carolina, 6:32898 (DOE/ET/14693—T3)
**Ketron, Inc., Wayne, PA (USA)**
Mine demonstrations of longwall dust control techniques. Technical status report, July 31, 1981-August 31, 1981, 6:32908 (DOE/ET/12532—T4)
**KMS Fusion, Inc., Ann Arbor, MI (USA)**
Laser heated gas-jet: a soft x-ray source, 6:34061 (KMSF-U—1109)
**Koch Process Systems, Westborough, MA (USA)**
Analysis of cooldown performance for ISABELLE helium refrigerator, 6:33681 (BNL—30009)
Cycle design for the ISABELLE helium refrigerator, 6:33679 (BNL—30006)
**KVB, Inc., Elmsford, NY (USA)**
Particulate emission characteristics of oil-fired urtility boilers, 6:32989 (EPRI-CS—1995)

## L

**Lawrence Berkeley Lab., CA (USA)**
Actinides-1981, 6:33621 (LBL—12441)
Alpha-spectroscopic techniques for field measurement of radon daughters, 6:33766 (LBL—10769)
Assessment of optimum aquatic microcosm design for pollution impact studies, 6:33821 (EPRI-EA—1989)
Computer simulation of organic and biological molecules, 6:33846 (LBL—12979)
Distributed energy systems in California's future: Interim report, Volume I, 6:33399 (LBL—6831-Rev.)
Efficient methods for calculating the success function of fixed-space replacement policies, 6:34193 (LBL—12370)
Energy efficiency buildings program, FY 1980, 6:33450 (LBL—11985)
Environmental pollutant studies: FY 1980, 6:33746 (LBL—11986)
Environmental programs for ocean thermal energy conversion (OTEC), 6:33154 (LBL—12977)
Gas cooled electrical leads for use on forced cooled superconducting magnets, 6:33637 (LBL—12783)
Incremental cooling load determination for passive direct gain heating systems, 6:33173 (LBL—12048)
Indentation and erosion of brittle materials, 6:33548 (LBL—11883)
Indoor air quality, 6:33758 (LBL—12887)
Kinetics of reactions in a wet flue-gas simultaneous desulfurization and denitrification system, 6:32878 (LBL—13063)
Low temperature diffusion of positive muons in copper, 6:33957 (LA-UR—81-2473)
Marine mammals of Hawaii: a bibliography, 6:33830 (LBL—13192)
Marine mammals of Puerto Rico: a bibliography, 6:33831 (LBL—13193)
Materials and Molecular Research Division annual report 1980, 6:33496 (LBL—12000)
Midway house-tightening project: a study of indoor air quality, 6:33458 (LBL—12777)
Mobile infiltration test unit: its design and capabilities - preliminary experimental results, 6:33457 (LBL—12259)
Molecular-beam system for the study of transient combustion processes, 6:33626 (LBL—13178)
Non-linear vacuum polarization in strong fields, 6:33974 (LBL—12972)
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)
Ocean thermal energy conversion programmatic environmental analysis, 6:33152 (LBL—10511-Vol.1)
Overview of active solar absorption/Rankine cooling program, 6:33174 (LBL—13054-Rev.)
Proceedings of the workshop on numerical modeling of thermohydrological flow in fractured rock masses, 6:33047 (LBL—11566)
Production and destruction of $D^-$ by charge transfer in metal vapors, 6:34180 (LBL—12995)
Program ROCMAS: introduction and user's guide, 6:33931 (LBL—12987)
Studies on toxicity of OTEC plant components on marine animals from the Gulf of Mexico. Final report, September 1, 1978-November 30, 1980, 6:33909 (DOE/ET/20512—T1)
Surface science of heterogeneous catalysis: possible applications in atmospheric sciences, 6:33590 (LBL—12986)
Verification of BLAST by comparison with measurements of a solar-dominated test cell and a thermally massive building, 6:33172 (LBL—11387)
What can we learn from inclusive spectra, 6:33969 (LBL—12950)
**Lawrence Livermore National Lab., CA (USA)**
Aberrations and focusability in large solid-state-laser systems, 6:34186 (UCRL—85645)
Airborne and field-temperature surveys compared at Long Valley KGRA, California, 6:33222 (UCRL—86148)
Calculations on seismic coupling of underground explosions in salt, 6:33720 (UCRL—53103)
Comparative assessment of five potential sites for magma: hydrothermal systems - geophysics, 6:33221 (UCRL—52980)
Computer modeling of piezoresistive gauges, 6:33702 (UCRL—85763-Rev.1)
Concerning technical means for dealing with aspects of the near-term information onslaught, 6:34198 (UCRL—86581)
Design of neutron streak camera for fusion diagnostics, 6:34072 (UCRL—86162)
Detonation-product behavior at large expansion: the underwater detonation of nitromethane, 6:33714 (UCRL—52903)
Development of the aluminum-air battery for electric vehicle applications, 6:33492 (UCRL—86560)
Development of uv-transparent fluorophosphate glass. Final report, July 10, 1980-January 10, 1981, 6:33564 (UCRL—15375)
Electromagnetic launcher: a new weapon, 6:33641 (UCRL—85877)
Elemental composition of atmospheric fine-particles emitted from coal burned in a modern electric power plant equipped with a flue-gas desulfurization system, 6:33762 (UCRL—85035)
Environmental, health, safety, and socioeconomic impacts associated with oil recovery from tar-sand deposits in the United States, 6:32998 (UCRL—53197)
Evaluation of shielded metal arc and flux cored metal arc welding consumables for fabrication of stainless steel magnet cases for 4K service, 6:33640 (UCRL—85564)
Fact retrieval for the 1980s, 6:34202 (UCRL—85749)
Free-surface velocity measurements of plates driven by reacting and detonating RX-03-BB and PBX-0404, 6:33715 (UCRL—86372)
High-explosive detonations in varying-oxygen atmospheres, 6:33716 (UCRL—86563)
High-pressure solvent extraction of methane from geopressured fluids, 6:33223 (UCRL—86515)
Hydrogen production based on magnetic fusion, 6:33065 (UCRL—86600)
Hyper-filter-fluorescer spectrometer for fusion x-ray diagnostics, 6:34073 (UCRL—86163)

Identifier protection in a distributed operating system, 6:34203 (UCRL—86143)
Laser heated gas-jet: a soft x-ray source, 6:34061 (KMSF-U—1109)
Lawrence Livermore National Laboratory Oil-Shale Project. Quarterly report, April-June 1981, 6:32994 (UCID—16986-81-2)
LLNL underground coal gasification project. Quarterly progress report, January-March 1981, 6:32842 (UCRL—50026-81-1)
Methodology and basic algorithms of the Livermore Economic Modeling System, 6:33383 (UCRL—53131)
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)
Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)
Predictive calculations of volatilities of metals and oxides in steam-containing environments, 6:33055 (UCRL—85553)
Quadrantal symmetry calculations for nonsymmetric half-plane filters, 6:34197 (UCRL—85156-Rev.1)
Results of calculations of external gamma-radiation exposure rates from fallout and the related radionuclide compositions. Operation Ranger, 1951, 6:33805 (UCRL—53152-Pt.1)
Solar furnace study of zinc sulfate decomposition, 6:33076 (UCRL—86622)
Streak camera measurements of laser pulse temporal dispersion in short graded-index optical fibers, 6:34185 (UCID—19176)
Summary of the LLNL one-dimensional transport-kinetics model of the troposphere and stratosphere: 1981, 6:33952 (UCID—19185)
Technical evaluation of the noise and isolation testing of the safety features actuation system at the Davis Besse Nuclear Power Station, Unit 1, 6:33298 (UCID—19104)
Use of alkali metal-acid phosphates for elevated temperature water electrolysis, 6:33077 (UCRL—86623)
Using spectral line profiles as a diagnostic of the plasma electron density, 6:34071 (UCID—19173)
XeF pump laser. Final technical report, 6:33649 (UCRL—15348)

**Lehigh Univ., Bethlehem, PA (USA). Dept. of Metallurgy and Materials Engineering**

Comparison of hydrostatic extrusion versus wire drawing as a method of producing $Nb_3Sn$ superconducting wire, 6:33499 (BNL—29941)

**Lockheed Palo Alto Research Labs., CA (USA)**

Cadmium sulfide/copper sulfide heterojunction cell research by sputter deposition. Quarterly technical progress report, December 1, 1980-February 28, 1981, 6:33119 (SERI/PR—9296-T1)

**Los Alamos National Lab., NM (USA)**

Application of the active well coincidence counter (AWCC) to high-enrichment uranium metal, 6:33060 (LA—8621-MS)
Bibliography Group T-3, 1955-1980, 6:33962 (LALP—81-29)
Biogeochemistry of uranium mill wastes program overview and conclusions, 6:33035 (LA—8861-UMT)
Computer modeling of an all-secondary explosive hot-wire device, 6:33708 (LA—8930-MS)
Effect of cyclic pulsed temperature on void growth in metals during irradiation, 6:33522 (LA-UR—81-2437)
ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)
Failure mode analysis using state variables derived from fault trees with application, 6:33317 (LA-UR—81-2595)
Finite element analysis of the split Hopkinson bar, 6:34044 (LA—8921-MS)
Future LAMPF experiments on lepton-number nonconservation, 6:33983 (LA-UR—81-2635)
Global kinetics for the shock-induced decomposition of heterogeneous explosives, 6:33709 (LA-UR—81-1835)
Heating remote rooms in passive solar buildings, 6:33171 (LA-UR—81-2518)
High-temperature logging for basic development of HDR reservoirs, 6:33218 (LA-UR—81-1765)
Hot dry rock geothermal energy development program. Annual report, fiscal year 1980, 6:33228 (LA—8855-HDR)
Hot dry rock geothermal prospects, 1981, 6:33219 (LA-UR—81-1807)
Importance of creep failure of hard rock in the near field of a nuclear-waste repository, 6:33037 (LA-UR—81-2584)
Improvements in explosive charges, 6:33718 (LA-tr—81-23)
Inclusive proton spectra and total reaction cross sections for proton-nucleus scattering at 800 MeV, 6:33997 (LA—8937-T)
Inertial fusion program, January 1-June 30, 1979, 6:34175 (LA—8114-PR)
Instrument for liquids, amorphous and power diffraction, 6:33578 (LA-UR—81-2531)
Intermediate energy proton and light-ion scattering, 6:33995 (LA-UR—81-2410)
Ion chamber gamma burst detector, 6:33936 (LA-UR—81-2591)
Low temperature diffusion of positive muons in copper, 6:33957 (LA-UR—81-2473)
Magnetic bearings, 6:33646 (LA-tr—81-19)
Measurement of gas density and temperature distributions in strongly rotating $UF_6$ using laser-induced fluorescence, 6:33619 (LA-UR—81-2530)
Microseismic activity observed during depressurization of an oil storage cavern in rock salt, 6:32987 (LA-UR—81-2622)
Multisource data set integration and characterization of uranium mineralization for the Montrose Quadrangle, Colorado, 6:33014 (LA—8807-MS)
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
Neutrino number of the universe, 6:33934 (LA-UR—81-2505)
Numerical simulation of the countercurrent flow in a gas centrifuge, 6:33016 (LA-UR—81-1821)
One hundred prime references on hydrogeochemical and stream sediment surveying for uranium as internationally practiced, including 60 annotated references, 6:33013 (LA—6647-MS)
Optical analysis and alignment applications using the infrared Smartt interferometer, 6:34176 (LA-UR—81-2468)
Optical tooling for Antares, 6:34177 (LA-UR—81-2469)
Oxidation of metal sulfites by iodine for use in thermochemical hydrogen cycles, 6:33073 (LA-UR—81-2477)
Passive-solar retrofit study for the United States Navy, 6:33170 (LA-UR—81-2500)
Phase aberrations and beam cleanup techniques in carbon-dioxide laser fusion systems, 6:34178 (LA-UR—81-2523)
Picosecond high-power switching at the Los Alamos National Laboratory, 6:33698 (LA—8720)
Pressure-induced transformation in a Pu-2at.% Al alloy, 6:33525 (LA-UR—81-2456)
Propagation of a liquid-liquid explosion, 6:33360 (LA—8971-MS)
Reduction of photosynthetically active radiation under extreme stratospheric aerosol loads, 6:33745 (LA—8938-MS)
Relaxation of geothermal-reservoir stresses induced by heat production, 6:33229 (LA—8954-MS)
Resource characterization for uranium mineralization in the Montrose $1^0$ x $2^0$ quadrangle, Colorado, 6:33015 (LA-UR—81-2451)
Shock-compression measurements at pressures greater than 1 TPa, 6:33521 (LA-UR—81-2426)
Some political issues related to future special nuclear materials production, 6:33061 (LA—8969-MS)
Space nuclear safety and fuels program. Progress report, 6:33071 (LA—8904-PR)
Space nuclear safety and fuels program. Progress report, April 1981, 6:33072 (LA—8968-PR)
Supernova hydrodynamics, 6:33935 (LA-UR—81-2575)
Survey of atomic physics issues in experimental inertial confinement research, 6:34184 (SAND—81-1864C)
Temperature-induced transformation in a Pu-2at.% Al alloy, 6:33524 (LA-UR—81-2455)
Ultra-high-density plasma experiments: MHD simulations, 6:34062 (LA-UR—81-2572)
Use of oxide decompositions in advanced thermochemical hydrogen cycles for solar heat sources. Application of the tricobalt tetraoxide-cobalt monoxide pair, 6:33074 (LA-UR—81-2628)
Use of Zernike polynomials and interferometry in the optical design and assembly of large carbon-dioxide laser systems, 6:34179 (LA-UR—81-2524)
User's guide to the hydrogen monitor, 6:33577 (LA—8957-MS)
Why high-capacity manipulators and lead glass windows, 6:33671 (LA-UR—81-2571)

**Los Alamos Scientific Lab., NM (USA)**

Development of two-phase flow and material-transport models for large-diameter drilling systems: program overview and preliminary results, 6:33636 (LA—8894-MS)
Investigations of Occidental Oil Shale, Inc., retort 3E spent shales, 6:32995 (LA—8792-MS)
Reaction rates from pressure-gauge measurements in reacting explosives, 6:33710 (LA-UR—81-2482)
Status of the free-electron laser experiment at Los Alamos, 6:33648 (LA-UR—81-2568)

Structural relaxation rates in amorphous Metglas alloys $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_{80}B_{90}$, 6:33523 (LA-UR—81-2444)

**Louisiana State Univ., Baton Rouge (USA). Dept. of Zoology and Physiology**

Progress report for mutagenic effect of radionuclides incorporated into DNA of Drosophilia melangaster, 6:33887 (DOE/EV/03728—T1)

**Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA)**

Low-Btu-gasifier emissions toxicology. Status report, December 1980, 6:32960 (LMF—85)

## M

**Maryland Univ., College Park (USA)**

Angular-correlation and coincidence studies of excited $0^+$ and other levels in the transitional Ce nuclides $^{142}Ce$, $^{144}Ce$, $^{146}Ce$ and $^{148}Ce$, 6:34017 (BNL—29690)

**Maryland Univ., College Park (USA). Dept. of Meteorology**

Climatological relationships between monthly mean surface temperature and mid-tropospheric heights. Progress report, November 1, 1980-June 30, 1981, 6:33721 (DOE/EV/10539—T1)

**Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)**

Holston-Pantex LX-17 formulation comparison, 6:33712 (MHSMP—81-38)

Proton and carbon-13 NMR study of stockpile-aged LX-09, 6:33711 (MHSMP—81-37)

**Massachusetts Inst. of Tech., Cambridge (USA)**

Manual for use with the computer code SUPERENERGY: data reduction version, 6:33304 (DOE/ET/37240—74TR)

Myocardial perfusion scintigraphy using a new technique, the mesh chamber. Progress report, September 1, 1978-May 1, 1981, 6:33689 (DOE/EV/04969—3)

**Massachusetts Inst. of Tech., Cambridge (USA). Aeroelastic and Structures Research Lab.**

General review of the MOSTAS computer code for wind turbines, 6:33241 (DOE/NASA/3303—1)

**Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.**

Availability of capital for developing photovoltaic markets, 6:33128 (MIT-EL—79-042)

Cost goals for a residential photovoltaic/thermal liquid collector system set in three northern locations, 6:33097 (MIT-EL—80-028)

Design and implementation of a demonstration supplementary control system, 6:33271 (MIT-EL—80-033)

Economics of photovoltaics in the commercial, institutional, and industrial sectors, 6:33130 (MIT-EL—80-008)

Flywheel storage for photovoltaics: an economic evaluation of two applications, 6:33129 (MIT-EL—80-002)

Impact on photovoltaic worth of utility rate and reform and of specific market, financial, and policy variables: a commercial/industrial/institutional sector analysis, 6:33131 (MIT-EL—80-025)

Institutional analysis of solar heating and cooling of housing: summary report, 6:33101 (MIT-EL—79-044)

Institutional analysis of the solar heating and cooling residential demonstration program, 6:33182 (MIT-EL—80-024)

Photovoltaic assisted residence with supplemental battery storage: searching for a complementarity, 6:33126 (MIT-EL—79-016)

Photovoltaic market analysis program: background, model development, applications and extensions, 6:33098 (MIT-EL—81-012)

Photovoltaics and the national park service: an institutional analysis, 6:33102 (MIT-EL—80-007)

PV1 model verification and validation, 6:33132 (MIT-EL—81-004)

Research design for institutional analysis of HUD's solar heating and cooling demonstration program, 6:33099 (MIT-EL—79-029)

Research on the external fluid mechanics of ocean thermal energy conversion plants. Report covering experiments in stagnant water, 6:33155 (MIT-EL—79-041)

Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)

Solar energy conversion systems engineering and economic analysis. Volume I, 6:33094 (MIT-EL—79-032-Vol.1)

Solar energy conversion systems engineering and economics analysis. Input definition. Volume II, 6:33095 (MIT-EL—79-033-Vol.2)

Solar heating and cooling of housing: five institutional analysis case studies, 6:33100 (MIT-EL—79-030)

Solar heating and cooling standard setting: an institutional analysis case study, 6:33181 (MIT-EL—79-045)

**Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center**

Novel limiter pump topologies, 6:34171 (DOE/ET/51013—6)

**Massachusetts Inst. of Tech., Lexington (USA)**

Availability of capital for developing photovoltaic markets, 6:33128 (MIT-EL—79-042)

Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)

**Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.**

Edge stresses in spherical-shell solar receivers, 6:33193 (DOE/ET/21015—11)

Solar radiation flux distributions in cavity receivers, 6:33142 (DOE/ET/21015—9)

**Massachusetts Univ., Amherst (USA)**

Assessment of wood-chipping machinery for harvesting non-commercial timber in New England, 6:33106 (DOE/ET/20077—T1)

Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)

**McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)**

5-Megawatt solar-thermal test facility, 6:33141 (CONF-7508108—1)

Second generation heliostat. Final report, 6:33197 (SAND—81-8177-Vol.1)

Second generation heliostat. Volume II. Definition of a heliostat manufacturing facility. Final report, 6:33198 (SAND—81-8177-Vol.2)

Second generation heliostat program, 6:33196 (SAND—81-8177-Exec.Summ.)

**Mid-American Solar Energy Complex, Bloomington, MN (USA)**

MASEC Solar 80 home designs, 6:33178 (MASEC-PA—80-007)

**Mid-American Solar Energy Complex, Minneapolis, MN (USA)**

Evaluation of the passive solar for agriculture program, 6:33179 (MASEC/R—81-045)

Quarterly report of solar federal buildings program in the MASEC region, 6:33180 (MASEC/R—81-059/1)

Solar energy training program for code enforcement personnel, 6:33176 (MASEC-CF—81-023)

Vocational-technical instructors passive-solar training workshop, 6:33175 (MASEC-CF—81-019)

Wood resources and utilization patterns in the North Central Region and energy needs for the manufacture of wood products, 6:33114 (MASEC/R—81-005)

**Mid-America Solar Energy Center, Minneapolis, MN (USA)**

Summary of passive solar multi-family design workshops, 6:33177 (MASEC-CF—81-035)

**Minnesota Dept. of Natural Resources, St. Paul (USA)**

Inventory of peat resources, Koochiching County, Minnesota, 6:32896 (DOE/ET/14692—T2App.A-D)

Inventory of peat resources Koochiching County, Minnesota. Appendix E. Site descriptions, 6:32897 (DOE/ET/14692—T2App.E)

Reconnaissance peatland surveys, 6:32902 (DOE/ET/14692—T1)

**Minnesota Energy Agency, St. Paul (USA)**

Moorhead district heating. Phase II. Final report, 6:33473 (DOE/CS/20074—1)

**Minnesota Gas Co., Minneapolis (USA)**

Peat biogasification development program, 6:33081 (DOE/ET/14696—T6)

**Minnesota Power and Light Co., Duluth (USA)**

Investigation of geomagnetically induced currents in the proposed Winnipeg-Duluth-Twin Cities 500-kV transmission line. Final report, 6:33279 (EPRI-EL—1949)

**Minnesota Univ., Minneapolis (USA)**

Nuclear structure study at intermediate energies. Annual progress report, November 1980-July 1981, 6:33992 (DOE/ER/04215—5)

**Minnesota Univ., Minneapolis (USA). Dept. of Electrical Engineering**
Investigation of geomagnetically induced currents in the proposed Winnipeg-Duluth-Twin Cities 500-kV transmission line. Final report, 6:33279 (EPRI-EL—1949)

**Minnesota Univ., St. Paul (USA)**
Examination of potential transportation impediments to the movement of coal, 6:32923 (DOE/ET/15299—T1)

**Minnick (L. John), Plymouth Meeting, PA (USA)**
Development of potential uses for the residue from fluidized-bed-combustion processes. Quarterly technical progress report, March-May 1981, 6:33466 (DOE/ET/10415—T4)

**Missouri Univ., Columbia (USA)**
Development of a longwall water jet mining machine. Final technical report, 6:32909 (DOE/ET/12542—T1)
Nuclear methods in environmental and energy research, 6:33784 (CONF-800433—)

**Mobil Tyco Solar Energy Corp., Waltham, MA (USA)**
Large area silicon sheet by EFG. Second quarterly report, April 1, 1981-June 30, 1981, 6:33110 (DOE/JPL/954355—81-18)

**Mound Facility, Miamisburg, OH (USA)**
Manganese glass-molybdenum metallized and copper brazed 99.5% alumina ceramics, 6:33549 (MLM—2850)

**Mueller Associates, Inc., Baltimore, MD (USA)**
Technology characterizations: environmental information handbook. Second edition, 6:33840 (DOE/EP—0028)

## N

**Nagoya Univ. (Japan)**
Design and performance of the new cathode readout proportional chambers in LASS, 6:33690 (SLAC-PUB—2642)

**National Academy of Sciences, Washington, DC (USA)**
Engineering for deep sea drilling for scientific purposes. Final report, 6:33664 (AD-A—092605)

**National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center**
Commerical (terrestrial) and modified solar array design studies for low cost, low power space applications, 6:33134 (NASA-TM—81622)
Effects of trace impurities in coal-derived liquid fuels on deposition and accelerated high-temperature corrosion of cast superalloys, 6:33509 (DOE/NASA/2593—22)
High-power baseline and motoring test results for the GPU-3 Stirling engine, 6:33490 (DOE/NASA/51040—31)
New ion exchange membranes, 6:33616 (NASA-TM—81670)
Preparation and characterization of electrodes for the NASA Redox storage system, 6:33441 (DOE/NASA/12726—13)
Preparation and evaluation of advanced electrocatalysts for phosphoric acid fuel cells. Sixth quarterly report, April-June 1981, 6:33440 (DOE/NASA/0176—81/2)
Program-management plan with critical-path definition for combustion augmentation with thermionic energy conversion (CATEC), 6:33438 (DOE/NASA/1062—9)
Test results of the Chrysler upgraded automotive gas-turbine engine: initial design, 6:33487 (DOE/NASA/51040—22)

**National Aeronautics and Space Administration, Cocoa Beach, FL (USA). John F. Kennedy Space Center**
Cold-air performance of compressor-drive turbine of Department of Energy upgraded automobile gas turbine engine. I. Volute-manifold and stator performance, 6:33486 (DOE/NASA/1011—34)

**National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center**
Development of the ARIES parachute system, 6:33639 (SAND—81-0208C)

**National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center**
Solar power satellite microwave transmission and reception, 6:33133 (NASA-CP—2141)

**National Bureau of Standards, Boulder, CO (USA)**
Evaluation of shielded metal arc and flux cored metal arc welding consumables for fabrication of stainless steel magnet cases for 4K service, 6:33640 (UCRL—85564)

**National Bureau of Standards, Washington, DC (USA). Center for Materials Science**
Materials research for the clean utilization of coal. Quarterly progress report, April-June 1981, 6:32835 (DOE/PR/06010—T7)

**National Center for Resource Recovery, Inc., Washington, DC (USA)**
Review of the literature on the use of trommels in waste processing and resource recovery, 6:33474 (DOE/CS/20167—6)

**National Oceanic and Atmospheric Administration, Oak Ridge, TN (USA). Atmospheric Turbulence and Diffusion Lab.**
Handbook on atmospheric diffusion models, 6:33724 (ATDL—81/5)

**Naval Civil Engineering Lab., Port Hueneme, CA (USA)**
Passive-solar retrofit study for the United States Navy, 6:33170 (LA-UR—81-2500)

**Nelson and Johnson Engineering, Boulder, CO (USA)**
Optical tooling for Antares, 6:34177 (LA-UR—81-2469)

**Nevada Bureau of Mines and Geology, Reno (USA)**
Low-to-moderate temperature geothermal resource assessment for Nevada, area specific studies. Final report, June 1, 1980-August 30, 1981, 6:33207 (DOE/NV/10039—3)

**Nevada Univ., Boulder City (USA). Desert Research Inst.**
Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981, 6:33192 (DOE/CS/30174—T2Vol.1)

**New Mexico Inst. of Mining and Technology, Socorro (USA)**
Supernova hydrodynamics, 6:33935 (LA-UR—81-2575)

**New Mexico Univ., Albuquerque (USA). Technology Application Center**
Hydrogen energy: a bibliography with abstracts. Quarterly update, January-March 1981, 6:33075 (TAC/H—81-001)
Solar photovoltaics: a bibliography with abstracts. Quarterly update, April-June 1981, 6:33122 (TAC/SP—81-002)
Solar power generation: a bibliography with abstracts. Quarterly update, January-March 1981, 6:33093 (TAC-STPG—81-001)

**North Carolina Univ., Chapel Hill (USA). Dept. of Geology**
Peat deposits of Dismal Swamp pocosins: Camden, Currituck, Gates, Pasquotank, and Perquimans Counties, North Carolina, 6:32898 (DOE/ET/14693—T3)

**Northeast Solar Energy Center, Boston, MA (USA)**
Solar consumer assurance: an assessment of mechanisms in the Northeast, 6:33183 (NESEC—9)

**Northern Research and Engineering Corp., Woburn, MA (USA)**
Program Plan: research and development for improved efficiency, small steam turbine project No. 1380, Phase II, 6:33468 (DOE/ET/15426—T7)

**Northern Resources, Inc., Billings, MT (USA)**
Feasibility and economic study of medium-Btu coal gas blended with high-Btu by-product gas as an industrial energy source at Billings, Montana. Final report, 6:33082 (DOE/FE/20219—2)

**Northwestern Univ., Evanston, IL (USA). Dept. of Civil Engineering**
Finite-element program for creep analysis of concrete structures, 6:33556 (CONF-810801—57)

**Northwestern Univ., Evanston, IL (USA). Dept. of Materials Science and Engineering**
Slip systems and solid solution softening/hardening in BCC metals, 6:33504 (CONF-810391—1)

**Nuclear Energy Services, Inc., Danbury, CT (USA)**
Proposed draft standard ANS 11.18: recommendations to facilitate decontamination and decommissioning, 6:33638 (PNL-SA—9635)

**Nuclear Regulatory Commission, King of Prussia, PA (USA). Region I**
Application of MORT analysis to emergency preparedness for nuclear power stations, 6:33362 (PNL-SA—9316)

**Nuclear Resources International, Atlanta, GA (USA)**
Domestic utility attitudes toward foreign uranium supply, 6:33391 (GJBX—182(81))

## O

**Oak Ridge Associated Universities, Inc., TN (USA)**
Radiative lifetime of the 6p $^4P^0$/sub 5/2/ level in Xe II, 6:33955 (CONF-810868—1)

**Oak Ridge Gaseous Diffusion Plant, TN (USA)**
Gamma-ray spectrometric determination of $UF_6$ assay with 1 percent precision for international safeguards. Part 1. Product and feed in 1S and 2S sample cylinders, 6:33576 (K/OA—5014-Rev.1)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Measurement of outdoor noise levels adjacent to K-25 facility, ORGDP, 6:33046 (K/SUB—13876-81/1)
Stream sediment detailed geochemical survey for Date Creek Basin, Arizona, 6:33006 (GJBX—243-81)
Working with asbestos, 6:33919 (K/RA—106)
**Oak Ridge National Lab., TN (USA)**
Beta limits in EBT and their implications for a reactor, 6:34065 (ORNL/TM—7857)
Chemical thermodynamic analysis of the interaction of 304 SS with the gases and the $CaSO_4$ deposit in the fluidized-bed combustor, 6:33507 (CONF-810943—2)
Coal and limestone feed testing for atmospheric fluidized bed combustion, 6:32948 (ORNL/TM—7724)
Comparison of results between the ballooning-modes codes BLOON and BALOON, 6:34063 (ORNL/CSD/TM—157)
Critical review of the mutagenic and other genotoxic effects of direct coal liquefaction, 6:33912 (ORNL—5721)
Cryogenic pressure testing of demountable seals for large-coil program applications, 6:33633 (CONF-810835—12)
Cycle and performance analysis of absorption heat pumps for waste heat utilization, 6:33471 (ORNL/TM—7852)
DARTAB: a program to combine airborne radionuclide environmental exposure data with dosimetric and health effects data to generate tabulations of predicted health impacts, 6:33889 (ORNL—5692)
Data collection and processing for the ACES, 6:33459 (ORNL/CON—59)
Description and use of the Monte Carlo code LILITA, 6:34019 (ORNL/TM—7295)
Electrical property studies of oxygen in Czochralski-grown neutron-transmutation-doped silicon, 6:34047 (CONF-800877—3)
Electrode design and performance of the ORNL positive ion sources, 6:34181 (ORNL/TM—7879)
Environmental radiological survey of the intermediate-level waste system pipeline, 6:33803 (ORNL/TM—7858)
Estimation problems associated with the Weibull distribution, 6:34194 (ORNL/CSD—79)
Evaluation of potential processes for recovery of metals from coal ash. Final report, 6:33469 (EPRI-CS—1992(Vol.1))
Experimental investigations of two-phase mixture level swell and axial void fraction distribution under high pressure, low heat flux conditions in rod bundle geometry, 6:33343 (CONF-810806—8)
Failure modes and effects analysis of a coal-slurry preheater, 6:32841 (ORNL/TM—7664)
Finite-element program for creep analysis of concrete structures, 6:33556 (CONF-810801—57)
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
Helical axial injection concept for cyclotrons, 6:33670 (CONF-810944—1)
High-speed photographic observation of plasma-limiter interactions in ISX-B, 6:34056 (CONF-810831—52)
In-situ electron microscope fracture studies of amorphous films, 6:33545 (CONF-810851—2)
Metals and Ceramics Division materials science program. Annual progress report for period ending June 30, 1981, 6:33529 (ORNL/TM—7970)
Meteorological Effects of Thermal Energy Releases (METER) program. Annual progress report, October 1979-September 1980, 6:33769 (ORNL/TM—7744)
Model compound study of the mechanism of $sp^2$-$sp^3$ carbon-carbon cleavage during the reduction of coals, 6:33606 (CONF-810914—4)
Novel limiter pump topologies, 6:34171 (DOE/ET/51013—6)
Ocean thermal energy conversion gas-desorption studies. Volume 2. Deaeration in a packed column and a barometric intake system, 6:33156 (ORNL/TM—7438-Vol.2)
One and a half centered expansion for ion-atom collisions, 6:33954 (CONF-800859—8)
ORELA electron guns, 6:33672 (ORNL/TM—7886)
ORNL rural electric-energy-demand forecasting model, 6:33427 (ORNL/TM—7863)
PAPIN: A Fortran-IV program to calculate cross section probability tables, Bondarenko and transmission self-shielding factors for fertile isotopes in the unresolved resonance region, 6:34028 (ORNL/TM—7883)
Population dose estimation from a hypothetical release of 2.4 x $10^6$ curies of noble gases and 1 x $10^4$ curies of $^{131}I$ at the Three Mile Island Nuclear Station, Unit 2, 6:33361 (ORNL/TM—7980)
Potential contribution of currently operating nuclear-fueled electric-generating units to reducing US oil consumption, 6:33392 (ORNL/Sub—80/40416/1)
Potential opportunities for revitalization of the Rochester, New York steam district heating system, 6:33479 (ORNL/TM—7757)
Preirradiation microstructrual development designed to minimize properties degradation during irradiation in austentic alloys, 6:33505 (CONF-810831—11)
Preparation of magnetic anomaly profile and contour maps from DOE-NURE aerial survey data. Volume I: processing procedures, 6:32999 (ORNL/CSD/TM—155-Vol.1)
Radiative lifetime of the 6p $^4P^0$/sub 5/2/ level in Xe II, 6:33955 (CONF-810868—1)
Role of engineering judgement and the computer in the management of material property data, 6:33495 (CONF-800804—43)
Selective load control for industrial customers, 6:33264 (ORNL/Sub—7399/1)
Self-consistent approximation beyond the CPA: Part II, 6:33506 (CONF-810866—1(Draft))
Simple-power-balance model for microwave heating in EBT, 6:34064 (ORNL/TM—7001)
Statistical coal structure analysis cross polarization/magic angle spinning (CP/MAS)-$^{13}C$-NMR spectroscopy: quantitative evaluation of aromaticity parameters, 6:32857 (CONF-810914—5)
Storage and solidification of MAW/LAW in underground caverns (Phase 2). Studies on product conveyance in fall pipelines. Reporting period, July 1, 1979-December 31, 1979, 6:33020 (ORNL-tr—4777)
Structure-property correlations for $TiB_2$-based ceramics densified using active liquid metals, 6:33546 (CONF-810856—1)
Tennessee Valley Authority atmospheric fluidized-bed combustor simulation interim annual report, January 1-December 31, 1980, 6:33265 (ORNL/TM—7847)
Thermolysis of naphthols, 6:32808 (CONF-810914—6)
US ceramic heat exchanger technology: status and opportunities, 6:33253 (CONF-810946—1)
Variation in plant response to ozone: a conceptual model of physiological events, 6:33908 (CONF-8009172—1)
**Oak Ridge Y-12 Plant, TN (USA)**
Digital control of machine tools, 6:33642 (Y—2227)
Minicomputer and computer numerical control maintenance, 6:33643 (Y/IA—152)
**Optical Coating Lab., Inc., City of Industry, CA (USA). Photoelectronics Div.**
Silicon solar cell process development, fabrication, and analysis. Ninth quarterly report, 1 January 1981-31 March 1981, 6:33111 (DOE/JPL/955089—81/11)

**Oregon State Univ., Corvallis (USA)**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)

**Oregon State Univ., Newport (USA). Marine Science Center**
Biogeochemical studies of technetium in marine and estuarine ecosystems. Progress report, 1 July 1980-31 July 1981, 6:33827 (DOE/EV/10251—3)
Biokinetic behavior of Tc in the red abalone, Haliotis rufescens: a reassessment, 6:33888 (DOE/EV/10251—4)

**OR/MS Dialogue, Inc., Cambridge, MA (USA)**
Telephone, mail, and personal questionnaires for data collection, 6:33162 (DOE/CS/30209—T4)

**Owens-Illinois, Inc., Toledo, OH (USA). Corporate Technology Div.**
Antireflecting film development. Final report, 6:33563 (UCRL—15373)

## P

**Pacific Gas and Electric Co., San Ramon, CA (USA)**
Research to develop guidelines for cathodic protection of concentric neutral cables. Interim report, 6:33281 (EPRI-EL—1970(Vol.2))

**Pacific Gas and Electric Co., San Ramon, CA (USA). Dept. of Engineering Research**
Research to develop guidelines for cathodic protection of concentric neutral cables. Interim report, 6:33280 (EPRI-EL—1970(Vol.1))

**Pacific Northwest Lab., Richland, WA (USA)**
Analysis of data from the US Department of Energy's meteorological validation program, 6:33243 (PNL-SA—9411)
Application of MORT analysis to emergency preparedness for nuclear power stations, 6:33362 (PNL-SA—9316)
Assessment of the long-range transport of residential woodstove fine-particulate emissions for two future United States energy scenarios, 6:33761 (PNL-SA—9606)
Comparison of regional scale effects of in-cloud conversion of $SO_2$ to $SO_4$/sup =/ in an eight-layer diabatic model with a single-layer model, 6:33760 (PNL-SA—8432)
Crystal structure and stoichiometry of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6$O/sub 2-1/2x/ system, 6:33591 (PNL-SA—9377)
Dose/response relationships and policy formulation, 6:34042 (PNL-SA—9317)
Engineering study of frequent refueling for improved uranium utilization in pressurized water reactors, 6:33297 (PNL-SA—9641)
Environmental concentration and migration of $^{129}I$, 6:33767 (PNL-SA—9140)
Epidemiological approaches to reproductive hazards of the workplace, 6:33913 (PNL-SA—9435)
Microdosimetry of lymphocytes irradiated by alpha particles, 6:33890 (PNL-SA—9315)
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
Problems in evaluating health effects of occupational and environmental exposures, 6:33891 (PNL-SA—9632)
Proposed draft standard ANS 11.18: recommendations to facilitate decontamination and decommissioning, 6:33638 (PNL-SA—9635)
Pulsed-irradiation creep in nickel, 6:33530 (PNL-SA—9266)
Radiological planning guide for DOE decommissioning operations, 6:33057 (PNL-SA—9262)
Relative effects of S, Sb and P on the intergranular fracture of iron and nickel tested at cathodic potentials, 6:33531 (PNL-SA—9446)
Review of simulation techniques for aquifer thermal energy storage (ATES), 6:33375 (PNL—3769)
Spectral response measurements for solar cells, 6:33116 (PNL-SA—9751)
Stress dependence of creep in Ni bombarded with 17-MeV deuterons, 6:33532 (PNL-SA—9728)
Technology change and energy consumption: a comparison of residential subdivisions, 6:33460 (PNL-SA—9049)
Wind speed simulation for economic evaluation of wind energy conversion systems, 6:33234 (PNL-SA—9149)

**Pennsylvania State Univ., University Park (USA)**
Mechanistic studies of carbon monoxide reduction. Progress report, August 1, 1980-August 1, 1981, 6:33080 (DOE/ER/10345—2)

**Pennsylvania Univ., Philadelphia (USA)**
Very-high-energy nuclear physics. Progress report, July 1, 1980-June 30, 1981, 6:33968 (DOE/ER/04660—1)

**Philadelphia Gas Works, PA (USA)**
Low/medium-Btu coal-gasification assessment of central plant for the city of Philadelphia, Pennsylvania. 6:32836 (DOE/RA/20222—2)

**Piedmont Engineers, Greenville, SC (USA)**
Nuclear energy center conceptual study. Phase III: site specific evaluation. Topical report, environmental, 6:33335 (DOE/OR/06074—1-Vol.3)

**Pittsburg and Midway Coal Mining Co., Englewood, CO (USA)**
Solvent-refined-coal (SRC) process. Quarterly technical progress report, July 1980-September 1980, 6:32809 (DOE/ET/10104—8)

**Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy**
Bremsstrahlung energy spectra from electrons of kinetic energy 1 keV $\leqq$ T $\leqq$ 2000 keV incident on neutral atoms 1 $\leqq$ Z $\leqq$ 92, 6:33959 (SAND—81-1337)

**Planning and Management Associates of Greater Washington, Inc., DC (USA)**
Commercialization survey for the Department of Energy's solar buildings demonstration program, 6:33191 (DOE/SF/11446—T1)

**Portsmouth Public Schools, VA (USA)**
Solar heating and hot water system installed at James Hurst Elementary School, Portsmouth, VA. Final Report, 6:33164 (DOE/NASA/CR—161830)

**Potomac Electric Power Co., Washington, DC (USA)**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 9. Design approaches: CAES, Appendix C. Major mechanical equipment. Final report, 6:33369 (EPRI-EM—1589(Vol.9)(App.C))
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 8. Design approaches: UPH. Final report, 6:33371 (EPRI-EM—1589(Vol.8))

**Princeton Univ., NJ (USA)**
Current driven nonideal instability in a force-free toroidal plasma, 6:34059 (GA-A—16418)

**Princeton Univ., NJ (USA). Plasma Physics Lab.**
Axisymmetric stability of vertically asymmetric tokamaks at large beta poloidal, 6:34069 (PPPL—1831)
Electromagnetic kinetic toroidal eigenmodes for general MHD equilibria, 6:34068 (PPPL—1830)
Helical equilibrium, 6:34067 (PPPL—1829)
Stabilizing windings for the tilting and shifting modes in an inductively formed spheromak, 6:34066 (PPPL—1814)
Stellarator program, 6:34182 (PPPL—1832)

**Proto-Power Management Corp., Groton, CT (USA)**
Fort St. Vrain improvement program plan. Draft final report, 6:33300 (DOE/SF/10748—T2)

**Purdue Univ., Lafayette, IN (USA). School of Materials Engineering**
Zero-flux planes and flux reversals in multicomponent diffusion. Progress report, January 1, 1981-August 31, 1981, 6:33508 (DOE/ER/10814—1)

## Q

**QEB, Inc., Lakewood, CO (USA)**
Airborne gamma-ray spectrometer and magnetometer survey: Peoria, Decater, Belleville Quadrangles, (IL). Final report, 6:33005 (GJBX—241-81-Vol.1)

**Quadrex, Richland, WA (USA)**
Proposed draft standard ANS 11.18: recommendations to facilitate decontamination and decommissioning, 6:33638 (PNL-SA—9635)

**Quantitative Economic Research, Inc., San Diego, CA (USA)**
Regional load-curve models: QUERI's model specification, estimation and validation. Final report, 6:33421 (EPRI-EA—1672(Vol.2))

## R

**RCA Labs., Princeton, NJ (USA)**
Amorphous boron-silicon-hydrogen alloys for thin-film heterojunction solar cells. Quarterly technical progress report No. 2, 1 September 1980-30 November 1980, 6:33117 (SERI/PR—0-9010-2)
Amorphous boron-silicon-hydrogen alloys for thin-film heterojunction solar cells. Quarterly technical progress report No. 3, 1 December 1980-28 February 1981, 6:33118 (SERI/PR—0-9010-3)

**Rho Sigma, Inc., North Hollywood, CA (USA)**
Variable capacity compressor controller, 6:33448 (DOE/CS/35224—T1)

**RMR Associates, Palo Alto, CA (USA)**
Cogeneration potential: enhanced oil recovery. Final report, 6:32970 (EPRI-EM—1996)

**Rocket Research Co., Redmond, WA (USA)**
Utilization of waste heat from major transformer substations. Volume 1. Generic study. Final report, 6:33477 (EPRI-EM—1968(Vol.1))
Utilization of waste heat from major transformer substations. Volume 2. Site-specific study. Final report, 6:33478 (EPRI-EM—1968(Vol.2))

**Rockwell International Corp., Canoga Park, CA (USA)**
Vibration signature analysis and acoustic-emmission monitoring at Brayton Point. Final report, 6:33262 (EPRI-CS—1938)

**Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group**
Achievements, findings, and lessons of the Phenix LMFBR power plant experience. Final report, 6:33305 (EPRI-NP—1973)
Structural damage from fission fragment irradiation in crystalline nuclear waste phases, 6:33022 (DOE/ET/41900—5)

**Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant**
Chemistry research and development. Annual progress report, November 1, 1979-October 31, 1980, 6:33622 (RFP—3180)
Probabilities of aircraft crashes at Rocky Flats and subsequent radioactive releases, 6:33768 (RFP—2462-Add.)
Ultrasonic evaluation of U - 3/4 Ti penetrators by amplitude and frequency analysis, 6:33655 (RFP—3208)

**Roth Associates, Inc., Bethesda, MD (USA)**
Evaluation of CHESS: New York asthma data 1971 to 1972. Volume 2, 6:33910 (EPRI-EA—1994(Vol.2))

## S

**Sandia National Labs., Albuquerque, NM (USA)**
Bremsstrahlung energy spectra from electrons of kinetic energy 1 keV $\leq$ T $\leq$ 2000 keV incident on neutral atoms 1 $\leq$ Z $\leq$ 92, 6:33959 (SAND—81-1337)
Circumferential stresses and crack opening displacements at a fractured well bore, 6:33932 (SAND—81-1271)
Deflagration-to-detonation transition (DDT) project. Semiannual report, June-November 1980, 6:33713 (SAND—81-0937)
Design and fabrication of the instrumented fuel elements for the Annular Core Research Reactor (ACRR), 6:33338 (SAND—80-2365)
Development of the ARIES parachute system, 6:33639 (SAND—81-0208C)
Dynamic shear-wave velocity measurements using interferometric techniques, 6:33964 (SAND—81-1135C)
Effects of ion implantation on the photoferroelectric properties of lead lanthanum zirconate titanate ceramics, 6:33561 (SAND—81-1834C)
Electrical conductivity and thermal decomposition of high temperature phenolic- and silicone-based materials, 6:33552 (SAND—81-0786C)
Evaluation of active and passive near-millimeter-wave radiometric imaging techniques for detection of concealed objects, 6:33062 (SAND—81-1051)
Evaluation of the SCR controller noise problem, 6:33491 (SAND—81-1814C)
Failure surface model for oil shale, 6:32993 (SAND—81-1128)
Guidance for implementing an Environmental, Safety, and Health Assurance Program. Volume I. A model plan for Institutional Environmental, Safety, and Health Assurance Programs, 6:33920 (SAND—81-0632)
Guidance for implementing an environmental, safety and health assurance program. Volume 14. Model guidelines for utilizing quality assurance support in environmental, safety and health assurance programs, 6:33921 (SAND—81-0645)
Heliostat operation at the Central Receiver Test Facility (1978-1980), 6:33146 (SAND—81-0275-Rev.)
High temperature electrical conductivity and thermal decomposition of phenolic- and silicon-based dielectrics for fireset housings, 6:33560 (SAND—81-0786)
High voltage, magnetically switched pulsed power systems, 6:33658 (SAND—81-0754C)
High-voltage air-core pulse transformers, 6:33657 (SAND—80-0451)
Performance testing of the TOLTEC TI-410 concentrating solar collector, 6:33195 (SAND—81-0369)
Phoenix II energy extraction and angular multiplexing experiments, 6:34183 (SAND—81-1472)
Power-law rheology and flow behavior of low-invasion coring fluids, 6:33230 (SAND—80-0933)
Preliminary report on a theory of authentication, 6:34195 (SAND—81-1007C)
Project DEEP STEAM: fourth meeting of the technical advisory panel, Albuquerque, NM, November 1980, 6:32971 (SAND—81-0043)
Recent advances in the study of structural phase transitions at high pressure, 6:34046 (SAND—81-1151C)
Solar thermal energy: abstracts of a special seminar for industry, 6:33185 (SAND—81-0373)
Survey of atomic physics issues in experimental inertial confinement research, 6:34184 (SAND—81-1864C)
Time-resolved wave profile measurements in copper to Megabar pressures, 6:33533 (SAND—81-1358C)
Toughening in glass ceramics through microstructural design, 6:33550 (SAND—81-0064C)
Transient temperature response of strain gages, 6:33700 (SAND—80-2689)
Wind ripple analysis, 6:33240 (DOE/DP/00789—T15)

**Sandia National Labs., Livermore, CA (USA)**
Comparative economics of solar thermal central receivers, 6:33147 (SAND—81-8236)
Conceptual design selection and development of a latent-heat thermal-energy-storage subsystem for a saturated-steam solar receiver and load, 6:33201 (SAND—81-8184)
Microcomputer-controlled communication network for Sandia National Laboratories' environmental test chambers, 6:33701 (SAND—81-1782)
Second generation heliostat. Final report, 6:33197 (SAND—81-8177-Vol.1)
Second generation heliostat. Volume II. Definition of a heliostat manufacturing facility. Final report, 6:33198 (SAND—81-8177-Vol.2)
Second generation heliostat program, 6:33196 (SAND—81-8177-Exec.Summ.)
Study of photovoltaic cost elements. Volume 1. Executive report. Volume 2. Project background. Final report, 6:33136 (SAND—81-7014/Vol.1-2)
Study of photovoltaic cost elements. Volume 4. Installation cost model for residential PV systems: users manual. Final report, 6:33138 (SAND—81-7014/Vol.4)
Study of photovoltaic cost elements. Volume 5. Installation cost model for intermediate PV systems: users manual. Final report, 6:33139 (SAND—81-7014/Vol.5)
Study of photovoltaic cost elements. Volume 3. Sandia National Laboratories photovoltaic systems design catalog. Final report, 6:33137 (SAND—81-7014/Vol.3)

**San Diego Gas and Electric Co., CA (USA)**
Design guide for Geothermal Test Facility, 6:33224 (DOE/ET/28443—T15)

**Sante Fe Corp., Alexandria, VA (USA)**
Sensitivity analysis of project appraisal variables. Volume II. Additional variables and composite scenarios, 6:33405 (DOE/ET/15078—T9)

**Schott Optical Glass, Inc., Duryea, PA (USA)**
Development of uv-transparent fluorophosphate glass. Final report, July 10, 1980-January 10, 1981, 6:33564 (UCRL—15375)

**Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.**
Tandem transport and ambipolarity in the resonant plateau regime, 6:34070 (SAI—254-81-262-LJ)
**Science Applications, Inc., McLean, VA (USA). Solar Technology Div.**
Parametric sensitivity study for solar-assisted heat-pump systems. Final report, 6:33186 (SERI/TR—98288-1)
**Seattle City Light, WA (USA)**
Utilization of waste heat from major transformer substations. Volume 1. Generic study. Final report, 6:33477 (EPRI-EM—1968(Vol.1))
Utilization of waste heat from major transformer substations. Volume 2. Site-specific study. Final report, 6:33478 (EPRI-EM—1968(Vol.2))
**Sheet Metal and Air Conditioning Contractors National Association, Vienna, VA (USA)**
Study guide for fundamentals of solar heating: a correspondence course for the air conditioning industry, 6:33165 (DOE/QQ/04038—T1)
**Skelly and Loy, Harrisburg, PA (USA)**
Evaluation of novel underground transport systems. Final report, 6:32907 (DOE/ET/11268—T3)
**Solar Energy Research Inst., Golden, CO (USA)**
Amorphous boron-silicon-hydrogen alloys for thin-film heterojunction solar cells. Quarterly technical progress report No. 2, 1 September 1980-30 November 1980, 6:33117 (SERI/PR—0-9010-2)
Amorphous boron-silicon-hydrogen alloys for thin-film heterojunction solar cells. Quarterly technical progress report No. 3, 1 December 1980-28 February 1981, 6:33118 (SERI/PR—0-9010-3)
Cadmium sulfide/copper sulfide heterojunction cell research by sputter deposition. Quarterly technical progress report, December 1, 1980-February 28, 1981, 6:33119 (SERI/PR—9296-T1)
Design and economics of direct-contact salt hydrate storage systems, 6:33203 (SERI/TP—631-1163)
Optical transparency of inexpensive salt solutions for construction of density-gradient ponds, 6:33199 (SERI/RR—641-615)
Overview and FY 1981 progress on open-cycle OTEC power systems, 6:33157 (SERI/TP—634-1282)
Parametric sensitivity study for solar-assisted heat-pump systems. Final report, 6:33186 (SERI/TR—98288-1)
Photoelectrochemical solar cells: stabilization of small-band-gap semiconductor in aqueous solution by surface-attached organic conducting polymer, 6:33120 (SERI/TP—233-1388)
Prospects for investment in solar energy, 6:33091 (SERI/TP—351-508)
Review of thermally regenerative electrochemical systems, 6:33442 (SERI/TR—332-416-Vol.2)
SERI Solar-Energy-Storage Program, 6:33202 (SERI/TP—620-1344)
Terrestrial solar spectral modeling, 6:33096 (SERI/TP—642-1343)
Thermal and electrochemical biomass conversion at SERI, 6:33121 (SERI/TP—622-1174)
**Solar Energy Research Inst., Western Australia (Australia)**
Status of solar energy research and development in Australia, 6:33090 (NP—1903916)
**Solarex Corp., Rockville, MD (USA)**
Module experimental process system development unit (MEPSDU). Quarterly report No. 2, March 1, 1981-May 31, 1981, 6:33113 (DOE/JPL/955902—81/2)
**Southern Co. Services, Inc., Birmingham, AL (USA)**
Evaluation of liquid-phase prilling as a technique for SRC solidification, 6:32810 (DOE/ET/10154—T14)
**Southwest Research Inst., San Antonio, TX (USA)**
Develop a winch-drawn dozer blade equipment system: modification A010-spoil-plane for leveling surface mine spoils. Semi-annual technical progress report, 6:32893 (DOE/ET/12394—T2)
**SRI International, Menlo Park, CA (USA)**
Analysis of potential attack on insulating materials exposed to sodium. Final report, 6:33306 (EPRI-NP—1986)
Blast/fire interactions. Proceedings of conference held in Asilomar, California, May 18-21, 1980, 6:33717 (FEMA—2563F)
Experimental studies in CDA work-energy attenuation. Quarterly technical progress report No. 22, 1 April- 30 June 1980, 6:33347 (DOE/SF/70097—T8)
Exploratory study of coal-conversion chemistry. Quarterly report, December 20, 1979-March 19, 1980, 6:32815 (DOE/ET/14855—6)
Exploratory study of coal-conversion chemistry. Quarterly report No. 9, March 20, 1980-June 19, 1980, 6:32816 (DOE/ET/14855—9)
Exploratory study of coal-conversion chemistry. Quarterly report, June 20, 1980-September 19, 1980, 6:32817 (DOE/ET/14855—12)
Small-scale experiments with an analysis to evaluate the effect of tailored pulse loading on fracture and permeability. Final report for Phase II, June 11, 1980-June 11, 1981, 6:32992 (DOE/MC/11577—T23)
**Stanford Linear Accelerator Center, CA (USA)**
Coordinate measurement by current division; a simple system for multichannel detectors, 6:33691 (SLAC-TN—81-6)
Design and performance of the new cathode readout proportional chambers in LASS, 6:33690 (SLAC-PUB—2642)
Fundamental tests and measures of the structure of matter at short distances, 6:33989 (SLAC-PUB—2776)
Quarkonium spectroscopy, 6:33970 (SLAC-PUB—2761)
Study of the emission performance of high-power klystrons: SLAC XK-5, 6:33673 (SLAC-TN—81-5)
**Stanford Univ., CA (USA). Petroleum Research Inst.**
Effects of confining pressure, pore pressure and temperature on absolute permeability. SUPRI TR-27, 6:32986 (DOE/ET/12056—27)
**State Univ. of New York, Buffalo (USA)**
Review of thermally regenerative electrochemical systems, 6:33442 (SERI/TR—332-416-Vol.2)
**Stephens Engineering Co., Inc., McLean, VA (USA)**
Commercialization survey for the Department of Energy's solar buildings demonstration program, 6:33191 (DOE/SF/11446—T1)
**Stoller (S.M.) Corp., New York (USA)**
DISFUL manual, 6:33018 (DOE/SR/01069—1)
Potential contribution of currently operating nuclear-fueled electric-generating units to reducing US oil consumption, 6:33392 (ORNL/Sub—80/40416/1)
**Stone and Webster Engineering Corp., Boston, MA (USA)**
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)
**Stonehart Associates, Inc., Madison, CT (USA)**
Preparation and evaluation of advanced electrocatalysts for phosphoric acid fuel cells. Sixth quarterly report, April-June 1981, 6:33440 (DOE/NASA/0176—81/2)
**Systems Control, Inc., Palo Alto, CA (USA)**
Combustion turbine combined-cycle R and D project priority analysis. Final report, 6:33260 (EPRI-AP—1943)

## T

**Tech. Reps., Inc., Albuquerque, NM (USA)**
Guidance for implementing an Environmental, Safety, and Health Assurance Program. Volume I. A model plan for Institutional Environmental, Safety, and Health Assurance Programs, 6:33920 (SAND—81-0632)
**Teledyne Energy Systems, Timonium, MD (USA)**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**TELIC Corp., Santa Monica, CA (USA)**
Cadmium sulfide/copper sulfide heterojunction cell research by sputter deposition. Quarterly technical progress report, December 1, 1980-February 28, 1981, 6:33119 (SERI/PR—9296-T1)
**Tennessee Univ., Knoxville (USA)**
Radiative lifetime of the 6p $^4P^0$/sub 5/2/ level in Xe II, 6:33955 (CONF-810868—1)
**Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering**
Phased-mission system reliability analysis. Volume 2: computer code. Final report, 6:33350 (EPRI-NP—1945(Vol.2))

**Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Demonstrations and Technology**
Potential for resource recovery from municipal solid waste in Warren County, Tennessee, 6:33480 (TVA/OP/EDT—81/39)
**Texas A and M Univ., College Station (USA). Dept. of Physics**
One and a half centered expansion for ion-atom collisions, 6:33954 (CONF-800859—8)
**Texas Univ., Austin (USA). Bureau of Economic Geology**
Assessment of in-place solution methane in tertiary sandstones: Texas Gulf Coast, 6:32990 (CONF-811026—5)
Pleasant Bayou No. 2: a review of rationale, ongoing research and preliminary test results, 6:33214 (CONF-811026—8)
Salinity of deep formation waters, Texas Gulf Coast - preliminary results, 6:32991 (CONF-811026—6)
**Texas Univ., Austin (USA). Center for Particle Theory**
Dirac's new relativistic wave equation in interaction with an electromagnetic field, 6:34049 (DOE/ER/03992—448)
**Texas Univ., Austin (USA). Fusion Research Center**
Kinetic theory of Alfven wave heating, 6:34057 (DOE/ET/53036—25)
**Tokyo Univ. (Japan). Inst. for Solid State Physics**
Soft phonons and magnetic ordering in the γ-phase transition metal alloys Fe/sub 1-x/Pd/sub x/, 6:34043 (BNL—30037)
**Tower Systems, Inc., Tacoma, WA (USA)**
Magma cooling-tower process pilot-plant demonstration. Final report, 6:33261 (EPRI-CS—1838)
**TRW, Inc., McLean, VA (USA). Energy Systems Planning Div.**
Combustion systems project appraisal analysis. Final report, 6:33388 (DOE/ET/13113—T2)
**TRW, Inc., Redondo Beach, CA (USA). Applied Technology Div.**
Optical analysis and alignment applications using the infrared Smartt interferometer, 6:34176 (LA-UR—81-2468)
**TRW Systems Group, McLean, VA (USA)**
Solar production of industrial process steam: TRW/ORE-Ida potato processing project, Phase I. Final report, 6:33163 (DOE/CS/32197—T1)
**Tufts Univ., Medford, MA (USA). Dept. of Physics**
Radiation reaction force and unification of electromagnetic and gravitational fields, 6:33988 (DOE/ER/03023—T1)

## U

**Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.**
Effects of tensile deformation on the strain memory behavior of uranium-niobium α'' martensite, 6:33534 (Y/DV—134)
Thermal-hydraulic differential sensitivity theory, 6:33312 (ORNL/CSD/TM—126)
**Union Carbide Corp., Sistersville, WV (USA)**
Low-cost solar-array project: experimental process system development unit for producing semiconductor-grade silicon using the silane-to-silicon process. Quarterly progress report, April-June 1981, 6:33109 (DOE/JPL/954334—19)
**UNISOR, Oak Ridge, TN (USA)**
Radiative lifetime of the 6p $^4$P°/sub 5/2/ level in Xe II, 6:33955 (CONF-810868—1)
**United Engineers and Constructors, Inc., Philadelphia, PA (USA)**
Feasibility of the high temperature gas-cooled reactor for cogeneration of process steam and electric power for a large oil refinery, 6:33322 (DOE/ET/34222—1)
**University of Southern California, Los Angeles (USA). Dept. of Electrical Engineering**
Contamination flashover of HVDC insulators. Final report, 6:33282 (EPRI-EL—2016)
**University of Southern Mississippi, Hattiesburg (USA). Dept. of Polymer Science**
Improved polymers for enhanced oil recovery: synthesis and rheology. Third annual report, October 1979-September 1980, 6:32968 (DOE/ET/12038—T3)
**URS/John A. Blume and Associates, Engineers, San Francisco, CA (USA)**
Experimental and theoretical study of a tall building subjected to wind loading, 6:33632 (CONF-810742—2)
**USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC**
Annual DOE active solar heating and cooling contractors' review meeting. Premeeting proceedings and project summaries, 6:33160 (CONF-810912—(Prelim.))
Annual report to the President and the Congress on the State Energy Conservation Program for calendar year 1980, 6:33394 (DOE/CE—0016)
Workshop on indoor air quality research needs, 6:33738 (CONF-801259—)
**USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC**
Managing large-scale models: DBS, 6:33384 (DOE/EP—0006)
**USDOE Bonneville Power Administration, Portland, OR**
Proceedings of the Pacific Northwest alternative and renewable energy resources conference, 6:33432 (CONF-7910232—)
**USDOE Chicago Operations Office, Argonne, IL**
Performance predictions of passive solar commercial buildings, 6:33161 (CONF-811034—1)
**Utah Univ., Salt Lake City (USA). Dept. of Mining and Fuels Engineering**
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, October-December 1979, 6:32813 (DOE/ET/14700—1)
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1980, 6:32814 (DOE/ET/14700—2)

## V

**Vassar Coll., Poughkeepsie, NY (USA)**
Experimental study of the sigma-nucleon system through the reaction d(K,π)SIGMA N. Progress report, January 1, 1981-December 31, 1981, 6:33967 (DOE/ER/04195—5)
**Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, April 1981-June 1981, 6:32833 (DOE/PC/30041—T6)
Evaluating the role of uncertainty in electric utility capacity planning, 6:33390 (DOE/EIA/10612—T26)
Evaluating the role of uncertainty in electric utility capacity planning (Appendices B and C), 6:33419 (DOE/EIA/10612—T26-Apps.B-C)
**VSE Corp., Alexandria, VA (USA)**
OTEC support services. Quarterly technical progress report No. 13, 15 May 1981-14 August 1981, 6:33151 (DOE/ET/21002—T19)

## W

**Washington State Univ., Pullman (USA). Coll. of Engineering**
Hydrologic studies support, INTERCOMP code conversion. Annual report. Research report 80/15-44, 6:33023 (DOE/RL/10119—1)
**Washington Univ., Seattle (USA). Dept. of Atmospheric Sciences**
Reactions of nitrogen oxides, ozone and sulfur in power plant plumes, 6:33744 (EPRI-EA—270)
**Washington Univ., Seattle (USA). Dept. of Mining and Metallurgical and Ceramic Engineering**
Stress dependence of creep in Ni bombarded with 17-MeV deuterons, 6:33532 (PNL-SA—9728)
**Washington Univ., Seattle (USA). Dept. of Oceanography**
Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)

**Western Michigan Univ., Kalamazoo (USA). Dept. of Chemistry**
Fundamentals of nitric oxide formation in fossil-fuel combustion. Progress report, 29 September-28 December 1980, 6:32944 (DOE/ET/10593—T2)

**Westinghouse Electric Corp., Concordville, PA (USA)**
Entrained gasification combined-cycle control study. Volume 2. Results. Final report, 6:33255 (EPRI-AP—1422-Vol.2)
Entrained gasification combined-cycle control study. Volume 3: model descriptions. Final report, 6:33256 (EPRI-AP—1422-Vol.3)

**Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Systems Div.**
Advanced cooling full-scale engine demonstration program. Final report, 6:33259 (EPRI-AP—1933)

**Westinghouse Electric Corp., Oak Ridge, TN (USA). Advanced Reactors Div.**
Contribution of Clinch River Breeder Reactor plant design and development to the LMFBR fuel cycle, 6:33302 (CONF-810941—1)

**Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.**
Lightweight concrete materials and structural systems for water tanks for thermal storage. Final report, 6:33372 (COO—4703-26)

**Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center**
Cell-module & fuel-conditioner development. 6th quarterly report, January-March 1981, 6:33439 (DOE/NASA/0161—7)
Optical analysis and alignment applications using the infrared Smartt interferometer, 6:34176 (LA-UR—81-2468)

**Westinghouse Electric Corp., Tampa, FL (USA). Nuclear Equipment Div.**
Development of automated welding process for field fabrication of thick walled pressure vessels, 6:33324 (DOE/ET/13511—T8)

**Westinghouse Research and Development Center, Pittsburgh, PA (USA)**
Acoustic waveguide technique for sensing incipient faults in underground power-transmission cables: including acousto-optic techniques. Final report, 6:33277 (DOE/ET/29335—T1)
Design of refractories for resistance to high-temperature erosion-corrosion. Final report, 6:33547 (EPRI-AP—1955)

**West Virginia Univ., Morgantown (USA)**
Thermodynamic behavior of compressed air energy storage systems, 6:33368 (DOE/OR/90337—T1)

**Wisconsin Univ., Madison (USA)**
Luminescent photoelectrochemical cells. 5: multiple emission from tellurium-doped cadmium sulfide photoelectrodes and implications regarding excited state communication, 6:33105 (A—093692)

**Wisconsin Univ., Madison (USA). Dept. of Mechanical Engineering and Statistics**
General formulation of an HCDA bubble rising in a sodium pool and the effect of nonequilibrium on fuel transport, 6:33344 (DOE/ET/37227—T1)

**Wisconsin Univ., Milwaukee (USA). Coll. of Engineering and Applied Science**
Experimental design for reflection measurements of highly reactive liquid or solid substances with application to liquid sodium, 6:33345 (DOE/ET/37227—T2)
Surface radiation properties of $ThO_2$ and other reactor materials, 6:33346 (DOE/ET/37227—T4)

## Y

**Yale Univ., New Haven, CT (USA)**
Plans for Brookhaven Fastbus during the next $\pi$ x $10^{16}$ nanoseconds, 6:33688 (BNL—30031)
Search for the violation of time-reversal invariance in K/sub $\mu$3/ decays, 6:33965 (BNL—30026)

## Z

**Zawadzki (Edward A.) Ltd., McMurray, PA (USA)**
Preliminary study: use of low-sulfur coal and coal cleaning in control of acid rain, 6:32866 (DOE/MC/14784—T1)

# AUTHOR INDEX

Authors' surnames are indexed in the form appearing in the abstracted publication; given names are reduced to initials. Each author entry gives the publication title and the citation number. Report numbers, if applicable, are given in parentheses at the end of the entry. For publications with multiple authors, an author entry is provided for each. Entries for the second and succeeding authors give references to the first author.

Because of problems involved in the mechanical preparation of this index, all accent marks are omitted. Changes in spelling introduced as a result of accent omission follow standard conventions.

## A


**Aamodt, R.,** *See* Murphy, H., 6:33229
**Abbott, L.F.,** Heavy quarks in electroproduction, 6:33978
**Abdel-Khalik, S.I.,** Fusion-fission hybrids and the environment: resource requirements, 6:34103 (CONF-801011—(Vol.2), pp 1227-1237)
*See* Esser, P.D., 6:34140
*See* Nietert, R.E., 6:34144
**Abdou, M.,** *See* Jung, J., 6:34094
**Abreu, K.E.,** *See* Smith, A.C. Jr., 6:34151
**Adair, R.K.,** *See* Morse, W.M., 6:33965
**Adams, E.E.,** Research on the external fluid mechanics of ocean thermal energy conversion plants. Report covering experiments in stagnant water, 6:33155 (MIT-EL—79-041)
**Adams, E.L.,** *See* Meier, M.M., 6:33577
**Adams, G.,** *See* Kalra, S.P., 6:33367
**Adams, P.H.,** Transient temperature response of strain gages, 6:33700 (SAND—80-2689)
**Adamson, M.G.,** High temperature chemomechanical interactions between alkali metals and urania-base oxide reactor fuels, 6:33308 (GEFR-SP—236)
**Ader, M.,** *See* Bates, J., 6:33540
**Adler, H.I.,** Cytoplasmic membrane fraction that promotes septation in an Escherichia coli lon mutant, 6:33898
**Adur, A.M.,** Effects of inhibitors on the thermal polymerization of $\beta$-pinene, 6:33553
**Adzic, R.R.,** Oxidation of formic acid and methanol on single crystal platinum electrodes, 6:33605 (BNL—29817)
**Aframian, A.,** Trace element analysis of human hair by proton induced X-ray excitation PIXE, 6:33884 (CONF-800433—, pp 442-448)
**Afrashteh, M.,** *See* Bamberger, J.A., 6:33683
*See* Brown, D.P., 6:33684
**Ahlquist, A.J.,** *See* White, G.C., 6:33903
**Ahmad, A.,** Neutron activation analysis without multi-element standards, 6:33731 (CONF-800433—, pp 205-215)
**Ahmed, H.U.,** Seismic analysis of ZPR-6 reactor facility, 6:33339
**Aiken, G.,** Design and performance of the new cathode readout proportional chambers in LASS, 6:33690 (SLAC-PUB—2642)
**Aitken, A.H.,** *See* Hirsch, E.G., 6:32875
**Akabane, A.,** *See* Terai, M., 6:33878
**Akerman, M.,** Laser pulse detector, 6:33650
**Akins, R.E.,** Wind ripple analysis, 6:33240 (DOE/DP/00789—T15)
**Alauddin, M.,** *See* Ehmann, W.D., 6:33879
**Albertson, V.D.,** *See* Kappenman, J.G., 6:33279
**Albillar, J.I.,** *See* Doss, J.D., 6:33870
**Albini, A.,** *See* Ganzerli Valentini, M.T., 6:33812
**Albright, J.,** Microseismic activity observed during depressurization of an oil storage cavern in rock salt, 6:32987 (LA-UR—81-2622)
**Alburger, D.E.,** *See* Warburton, E.K., 6:34009
**Alcorn, J.S.,** Superconducting toroidal field coil system for STARFIRE, 6:34089 (CONF-801011—(Vol.1), pp 350-359)
**Aldrich, J.,** *See* Goff, F.E., 6:33219
**Alger, R.S.,** Blast/fire interactions. Proceedings of conference held in Asilomar, California, May 18-21, 1980, 6:33717 (FEMA—2563F)
**Alire, R.M.,** Low permeability materials for tritium and tritium removal with organic materials, 6:34097 (CONF-801011—(Vol.1), pp 498-501)
**Allam, E.M. Sr.,** Laboratory development of +-600 kV dc pipe cable system, 6:33284
**Allam, I.M.,** Analysis of potential attack on insulating materials exposed to sodium. Final report, 6:33306 (EPRI-NP—1986)
**Allard, B.,** *See* O'Kelley, G.D., 6:33824
**Allen, W.O.,** *See* Berwald, D.H., 6:34120, 6:34124
**Allwine, K.J.,** Technique for planning and managing industrial growth from the air-quality standpoint, 6:33835 (PNL-SA—9419)
**Allwine, K.J. Jr.,** Assessment of the long-range transport of residential woodstove fine-particulate emissions for two future United States energy scenarios, 6:33761 (PNL-SA—9606)
**Alm, A.L.,** Options for fueling America's transportation, 6:33463
**Alpert, D.J.,** Resolving the sources of airborne particles for the regional air pollution studies, 6:33726 (CONF-800433—, pp 61-81)
**Alton, G.D.,** Design features and focal properties of simple three element two- or three-dimensional lens systems for decelerating intense ion beams to very low energies, 6:33668
*See* Compton, R.N., 6:33961
**Alvis, R.L.,** Solar thermal energy: abstracts of a special seminar for industry, 6:33185 (SAND—81-0373)
**Amano, J.,** Direct experimental determination of the particle reflection coefficients of low-energy (100 to 1500 eV) $^3$He and $^4$He atoms from the (110) plane of tungsten, 6:33956 (DOE/ER/03158—93)
**Amon, D.M.,** Project demonstration of wind-turbine electricity: interconnecting a northern Michigan fruit farm with a major utility, 6:33242 (DOE/R5/10226—1)
**Amundson, N.R.,** *See* Sundaresan, S., 6:32847
**An, S.,** *See* Miya, K., 6:34085
**Ananthaswamy, H.N.,** *See* Schild, D., 6:33860
**Andersen, R.A.,** *See* Edelstein, N.M., 6:33620
**Anderson, A.B.,** *See* Ginsberg, M.J., 6:33710
*See* Wackerle, J., 6:33709
**Anderson, C.E.,** *See* Henning, S.J., 6:32884
**Anderson, C.W.,** *See* Smart, J.E., 6:33874
**Anderson, D.F.,** Imaging alpha particle detector, 6:33694
**Anderson, D.L.,** Instrumental prompt gamma activation analysis of energy-related samples and standards, 6:33777 (CONF-800433—, pp 597-603)
*See* Zoller, W.H., 6:33728
**Anderson, N.G.,** *See* Edwards, J.J., 6:33848
*See* Willard, K.E., 6:33847
**Anderson, W.W.,** *See* Thornton, J.A., 6:33119
**Andersson, B.,** Verification of BLAST by comparison with measurements of a solar-dominated test cell and a thermally massive building, 6:33172 (LBL—11387)
*See* Sullivan, P.W., 6:33173
**Andersson, C.A.,** Design of refractories for resistance to high-temperature erosion-corrosion. Final report, 6:33547 (EPRI-AP-1955)
**Andrews, P.L.,** *See* Smits, R.G., 6:33637
**Angerman, H.,** *See* Wahlig, M., 6:33174
**Anklam, T.M.,** Experimental investigations of two-phase mixture level swell and axial void fraction distribution under high pressure, low heat flux conditions in rod bundle geometry, 6:33343 (CONF-810806—8)
**Antai, S.P.,** Degradation of softwood, hardwood, and grass lignocelluloses by two Steptomyces strains, 6:33872
**Appelman, E.H.,** *See* Richards, R.R., 6:33596
**Archey, J.,** *See* Cunniff, R.A., 6:33233
**Arends, J.,** *See* McKeown, R.D., 6:34001

**Arin, H.,** *See* Rosenfeld, A., 6:33456
**Armstrong, G.R.,** Evaluation of high-pressure containment buildings for LMFBR's, 6:33359 (HEDL-SA—2292-FP)
**Arneson, S.O.,** *See* Ziff, J.J., 6:33311
**Arora, J.,** *See* Paganessi, J.E., 6:32942
**Asay, J.R.,** *See* Chhabildas, L.C., 6:33533
**Ashby, W.C.,** Public myths about reclamation, 6:32882 (ANL/LRP-TM—20, pp 37-44)
**Ashman, E.N.,** Solar energy system performance evaluation: Montecito Pines, Santa Rosa, California, November 1979-April 1980, 6:33188 (SOLAR/1045—80/14)
**Ashworth, C.P.,** *See* Smith, A.C. Jr., 6:34151
**Aston, D.,** *See* Aiken, G., 6:33690
**Athey, G.F.,** *See* Ramsdell, J.V., 6:33234
**Atkins, J.M.,** *See* Reed, C.W., 6:33276
**Attanasi, E.D.,** World oil resource estimates: differences and difficulties, 6:33414 (EPRI-WS—79-182, pp 3.10.1-3.10.16)
**Atwood, N.D.,** *See* Hill, M.W., 6:33775
**Auble, R.L.,** Evaluation of carbon stripper foils for heavy-ion accelerators, 6:34010
**Augusto, O.,** *See* Packer, L., 6:33854
**Avitzur, B.,** *See* Thadani, V., 6:33499
**Ayala, F.J.,** *See* Mueller, L.D., 6:33862
*See* Tosic, M., 6:33863
**Ayatollahi, M.S.,** *See* Noorishad, J., 6:33929, 6:33931

## B

**Babcock, R.V.,** Fusion power plant laser driver system, 6:34112 (CONF-801011—(Vol.2), pp 1409-1416)
**Babu, S.P.,** *See* Knight, R.A., 6:32941
**Baedecker, P.A.,** Comparisons of peak-search and photopeak-integration methods in the computer analysis of gamma-ray spectra, 6:33772 (CONF-800433—, pp 15-24)
**Baer, D.R.,** *See* Jones, R.H., 6:33531
**Bahor, M.P.,** *See* Niece, J.E., 6:32877
**Bailey, A.,** Variation of minor and trace elements in coals from unknown geologic settings, 6:33782 (CONF-800433—, pp 685-691)
**Bailey, V.,** Electron-beam-driven, compact, steady-state tokamaks, 6:34168 (CONF-801011—(Vol.3), pp 1115-1119)
**Bainum, D.E.,** *See* Horen, D.J., 6:34020
**Bair, J.K.,** *See* Auble, R.L., 6:34010
**Baisden, P.A.,** *See* Hulet, E.K., 6:34030
**Baker, C.C.,** *See* Gohar, Y., 6:34119
**Baker, R.W.,** *See* Wade, J.E., 6:33237
**Balcomb, J.D.,** Heating remote rooms in passive solar buildings, 6:33171 (LA-UR—81-2518)
**Baldwin, D.E.,** Generating end plug potentials in tandem mirror plasma confinement by heating thermal particles so as to escape low density end stoppering plasmas, 6:34190
**Balestrino, J.M.,** *See* Hayward, J.C., 6:32870
**Ballinger, M.Y.,** *See* Ramsdell, J.V., 6:33234
**Balog, S.H.,** *See* Bolivar, S.L., 6:33014, 6:33015
**Baltz, A.J.,** *See* Carlson, B.V., 6:34025
**Balzer, L.,** *See* Hatfield, M.A., 6:32955
**Bamberger, J.A.,** MAGCOOL: the production cooling facility for ISABELLE magnets, 6:33683 (BNL—30011)
*See* Brown, D.P., 6:33684
**Bangerter, R.,** *See* Faltens, A., 6:34110
**Baptista, G.B.,** *See* Paschoa, A.S., 6:33813
**Baram, M.S.,** Impacts of Federal clean air law on district-heating opportunities, 6:33770 (BNL—51389)
**Barbee, D.D.,** *See* Filby, R.H., 6:33825
**Barclay, J.A.,** 4 K to 20 K rotational-cooling magnetic refrigerator capable of 1 mW to 'GT' 1 W operation, 6:33634
**Barczak, T.M.,** *See* Goode, C.A., 6:32903
**Bard, C.S.,** *See* Butz, T.R., 6:33006
**Baris, J.,** *See* Stonehart, P., 6:33440
**Barish, S.J.,** *See* Derrick, M., 6:33973
**Barnaby, B.E.,** *See* Bassett, R.B., 6:33491
**Barnes, A.V.,** *See* Kennett, R.G., 6:33972
**Barney, D.L.,** Calcium/metal sulfide battery development program. Progress report, October 1979-September 1980, 6:33376 (ANL—81-14)
**Barrette, J.,** New surface phenomena in heavy-ion-induced reactions, 6:33996
**Barros Leite, C.V.,** *See* Paschoa, A.S., 6:33813
**Barry, K.,** Power conversion and balance of plant considerations for the STARFIRE commercial tokamak reactor, 6:34167 (CONF-801011—(Vol.3), pp 1103-1114)
**Bartholomew, R.J.,** Failure mode analysis using state variables derived from fault trees with application, 6:33317 (LA-UR—81-2595)
**Bartlett, N.,** *See* Edelstein, N.M., 6:33620
**Barton, N.,** Importance of joint parameters on deformations observed in dynamically loaded models of large excavations, 6:33926 (DPST—81-262, pp 6p, Paper 4)
**Bartsch, R.G.,** *See* La Mar, G.N., 6:33593
**Bassett, R.B.,** Evaluation of the SCR controller noise problem, 6:33491 (SAND—81-1814C)
**Batakis, A.,** *See* White, D.J., 6:32951
**Batchelor, D.B.,** Simple-power-balance model for microwave heating in EBT, 6:34064 (ORNL/TM—7001)
**Bateman, G.,** Bundle divertor studies, 6:34169 (CONF-801011—(Vol.3), pp 1143-1151)
**Bateman, W.,** Nuclear waste isolation, 6:33042
**Bates, J.,** Phase relations in the thorium-cadmium system, 6:33540
**Bates, J.F.,** Effects of transmutation products on swelling in 316 stainless steel, 6:33514 (HEDL-SA—2342-FP)
Empirical development of irradiation-induced swelling design equations, 6:33340
*See* Powell, R.W., 6:33513
**Bathke, C.G.,** ELMO Bumpy Torus Reactor, 6:34165 (CONF-801011—(Vol.3), pp 1055-1065)
**Bauer, J.V.,** *See* Brockington, J.W., 6:32831
**Bauer, R.E.,** Instrumented in-reactor test capabilities in FFTF, 6:34174 (HEDL-SA—2476-FP)
*See* Puigh, R.J., 6:33517
**Bauke, W.,** Optical tooling for Antares, 6:34177 (LA-UR—81-2469)
**Bauman, F.,** *See* Andersson, B., 6:33172
**Bavinger, B.A.,** Relational methodology for integrating and analyzing field test and research data describing enhanced oil recovery, 6:32967 (DOE/ET/10145—72)
**Baxley, P.T.,** *See* Pahwa, S.B., 6:33930
**Bazant, Z.P.,** Finite-element program for creep analysis of concrete structures, 6:33556 (CONF-810801—57)
**Beacher, B.,** Improved particle trajectory calculations through turbomachinery affected by coal ash particles, 6:32943
**Beal, G.W.,** *See* Russell, P.L., 6:32953
**Beall, G.W.,** *See* O'Kelley, G.D., 6:33824
**Beasley, T.M.,** Biogeochemical studies of technetium in marine and estuarine ecosystems. Progress report, 1 July 1980-31 July 1981, 6:33827 (DOE/EV/10251—3)
Biokinetic behavior of Tc in the red abalone, Haliotis rufescens: a reassessment, 6:33888 (DOE/EV/10251—4)
**Beauchamp, J.L.,** Application of ion cyclotron resonance spectroscopy, photoionization mass spectrometry and photoelectron spectroscopy to study the properties and reactions of ions in gases, 6:33588 (CALT—767P8-8)
**Beaudry, B.J.,** *See* Takeshita, T., 6:33559
**Becker, R.L.,** *See* Reading, J.F., 6:33954
**Begovich, C.L.,** DARTAB: a program to combine airborne radionuclide environmental exposure data with dosimetric and health effects data to generate tabulations of predicted health impacts, 6:33889 (ORNL—5692)
**Behling, S.R.,** *See* Hsu, M., 6:33341
**Beier, F.J.,** Examination of potential transportation impediments to the movement of coal, 6:32923 (DOE/ET/15299—T1)
**Bell, D.E.,** Pollution control for a multi-fuel burning facility, 6:33482
**Bell, J.A.,** *See* Borg, D.C., 6:33852
**Bell, R.B.,** Methodology and basic algorithms of the Livermore Economic Modeling System, 6:33383 (UCRL—53131)
**Bell, R.J.,** *See* Diaz-Tous, I.A., 6:32925
**Beller, M.,** *See* D'Acierno, J., 6:33398
**Benford, J.,** *See* Bailey, V., 6:34168
**Benjamin, B.M.,** *See* Collins, C.J., 6:33606
**Benkovitz, C.M.,** MAP3S/RAINE emissions inventory. Progress report, December 1980, 6:33725 (BNL—51378)
**Benner, W.,** Oxidation of $SO_2$ by wet soot particles: application to clouds, fogs, and plumes, 6:33748 (LBL—11986, pp 5.5-5.7)
**Bennett, L.C.,** Microcomputer-controlled communication network for Sandia National Laboratories' environmental test chambers, 6:33701 (SAND—81-1782)
**Benson, R.C.,** *See* Maloney, K.L., 6:32935
**Bereznai, T.,** *See* Ahmad, A., 6:33731

**Berger, C.D.,** Population dose estimation from a hypothetical release of 2.4 x $10^6$ curies of noble gases and 1 x $10^4$ curies of $^{131}I$ at the Three Mile Island Nuclear Station, Unit 2, 6:33361 (ORNL/TM—7980)
**Bergman, R.G.,** *See* Jones, W.D., 6:33594
**Berman, B.L.,** *See* Pywell, R.E., 6:34002
**Berman, S.,** Energy-efficient lighting program, 6:33454 (LBL—11985, pp 4.40-4.45)
*See* Selkowitz, S., 6:33453
**Bernard, J.R.,** Comparison of reclamation costs: West and Midwest, 6:32958 (ANL/LRP-TM—20, pp 105-108)
**Bernard, L.C.,** GATO: an MHD stability code for axisymmetric plasmas with internal separatrices, 6:34060 (GA-A—16441)
**Bernstein, I.,** Engineering study of frequent refueling for improved uranium utilization in pressurized water reactors, 6:33297 (PNL-SA—9641)
**Berst, A.H.,** What baghouse is best for your industrial boiler: reverse air or pulse jet, 6:33273
**Berthelot, C.,** Instrumental photon activation analysis of Cd and Pb in zinc ores, with a rotating device for intermittent irradiations, 6:33792 (CONF-800433—, pp 326-331)
Non-destructive multi-element photon activation analysis of river sediments, 6:33810 (CONF-800433—, pp 119-126)
**Bertrand, F.E.,** *See* Fulmer, C.B., 6:34013
**Berwald, D.H.,** Fission suppressed tandem mirror hybrid reactor options, 6:34117 (CONF-801011—(Vol.2), pp 1465-1474)
Fuel cycle issues for suppressed fission-fusion breeders, 6:34124 (CONF-801011—(Vol.2), pp 1589-1597)
Parametric systems analysis for ICF hybrid reactors, 6:34115 (CONF-801011—(Vol.2), pp 1434-1443)
Suppressed fission blanket concepts for inertial confinement fusion, 6:34120 (CONF-801011—(Vol.2), pp 1505-1517)
**Best, C.,** *See* Venkataramiah, A., 6:33909
**Betts, R.R.,** High spin resonances in $^{28}Si$ + $^{28}Si$ scattering, 6:34011
**Beyerlein, S.W.,** Possibility of multiple temperature maxima in geologic repositories for spent fuel from nuclear reactors, 6:33043
**Beynon, T.D.,** Developments in blanket neutronics for CTR's, 6:34092 (CONF-801011—(Vol.1), pp 411-418)
**Bibler, N.E.,** Effects of high radiation doses on Linde Ion Siv IE-95, 6:33028 (DP-MS—81-18)
**Bickford, W.E.,** Activation product transport in helium cooled fusion systems, 6:34104 (CONF-801011—(Vol.2), pp 1238-1247)
**Biefeld, R.M.,** *See* Johnson, R.T. Jr., 6:33552, 6:33560
**Bielski, B.H.J.,** *See* Long, C.A., 6:33598
**Biermann, A.H.,** *See* Ondov, J.M., 6:33762
**Biersack, J.P.,** Monte Carlo computer program for the transport of energetic ions in amorphous targets, 6:34041
**Biggin, H.C.,** Feasibility of using a novel pulsed neutron source for in vivo: prompt gamma analysis, 6:33866 (CONF-800433—, pp 286-295)
**Bilicki, Z.,** Flow in geothermal wells. Part IV. Transition criteria for two-phase flow patterns, 6:33226 (DOE/ET/27225—9)
**Billone, M.C.,** *See* Liu, Y.Y., 6:33307
**Billquist, P.J.,** Improved extraction of negative ion beams from the inverted sputter source, 6:33677
**Bingham, C.R.,** *See* Braga, R.A., 6:34027
*See* Pegg, D.J., 6:33955
*See* Toth, K.S., 6:34024
**Bird, J.D.,** *See* Carpenter, L.K., 6:32952
**Bird, N.,** Impact of motor-gasoline price/availability trends on selected minority and disadvantaged populations, 6:32980 (DOE/MI/01006—T1-Pt.1)
**Bird, R.E.,** Terrestrial solar spectral modeling, 6:33096 (SERI/TP—642-1343)
**Bischof, W.,** *See* Wilde, H.R., 6:33734
**Blacic, J.D.,** Importance of creep failure of hard rock in the near field of a nuclear-waste repository, 6:33037 (LA-UR—81-2584)
**Black, J.K.,** *See* Morse, W.M., 6:33965
**Blackaller, G.S.,** *See* Lane, G.J., 6:33660
**Blank, M.L.,** In vivo metabolism of a new class of biologically active phospholipids: 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine, a platelet activating-hypotensive phospholipid, 6:33864
**Blankenship, J.,** World oil prices, 6:33406 (EPRI-WS—79-182, pp 3.1.1-3.1.19)
**Blask, J.,** US institutions: the Export-Import Bank, 6:32983 (EPRI-WS—79-182, pp 3.3.1-3.3.4)
**Blatt, S.,** *See* Leipuner, L.B., 6:33688
**Blatt, S.R.,** *See* Morse, W.M., 6:33965
**Bledsoe, J.L.,** Data collection and processing for the ACES, 6:33459 (ORNL/CON—59)
**Blevins, R.P.,** Thermal-energy-storage devices, 6:33461
**Blink, J.A.,** *See* Berwald, D.H., 6:34120
**Block, D.A.,** *See* McClelland, J.F., 6:33169
**Blomsterber, A.,** *See* Grimsrud, D., 6:33451
**Blomsterberg, A.K.,** Mobile infiltration test unit: its design and capabilities - preliminary experimental results, 6:33457 (LBL—12259)
**Bloom, E.E.,** *See* Scott, J.L., 6:34126
**Blue, T.,** *See* Greenspan, E., 6:34154
**Bobbie, R.J.,** Effects of light on biomass and community structure of estuarine detrital microbiota, 6:33917
**Bobrowski, K.,** *See* Raghavan, N.V., 6:33618
**Bodhaine, B.,** *See* Rosen, H., 6:33753
**Bodmer, A.R.,** Classical-equations-of-motion calculations of multiplicities for high-energy collisions of $^{20}Ne$ + $^{20}Ne$, 6:34012
**Bodvarsson, G.S.,** Numerical model CCC, 6:33212 (LBL—11566, pp 102-110)
**Bohrmann, S.,** Finite particle number effects in high-energy nuclear collisions. Implications on pion spectra, 6:33971
**Bolen, P.D.,** *See* Viswanathan, V.K., 6:34176
**Bolivar, S.L.,** Multisource data set integration and characterization of uranium mineralization for the Montrose Quadrangle, Colorado, 6:33014 (LA—8807-MS)
Resource characterization for uranium mineralization in the Montrose 1° x 2° quadrangle, Colorado, 6:33015 (LA-UR—81-2451)
*See* Sharp, R.R. Jr., 6:33013
**Bonner, G.W.,** *See* Mallett, C.W., 6:32900
**Booker, M.K.,** Role of engineering judgement and the computer in the management of material property data, 6:33495 (CONF-800804—43)
**Borek, C.,** Regulation of retinol-binding protein metabolism by glucocorticoid hormones in cultured $H_4II$ $EC_3$ liver cells, 6:33849
**Borenstein, S.R.,** Fine-grained hodoscopes based on scintillating optical fibers, 6:33686 (BNL—29923)
**Borg, D.C.,** Cytotoxic reactions of free radical species of oxygen, 6:33852
**Borison, A.B.,** Evaluating R and D options under uncertainty. Volume 1. Pulverized-coal development strategies. Final report, 6:33424 (EPRI-EA—1964(Vol.1))
Evaluating R and D options under uncertainty. Volume 2. Atmospheric fluidized-bed combustion commercialization strategies. Final report, 6:33425 (EPRI-EA—1964-Vol.2)
Evaluating R and D options under uncertainty. Volume 3. An electric-utility generation-expansion planning model. Final report, 6:33426 (EPRI-EA—1964(Vol.3))
**Borrass, K.,** Burn stabilization of an ignited tokamak in a static or pseudostatic vertical field, 6:34080 (CONF-801011—(Vol.1), pp 154-159)
**Bosler, G.E.,** *See* Menlove, H.O., 6:33060
**Boss, A.P.,** *See* Tohline, J.E., 6:33945
**Bouchon, M.,** *See* Pratt, H.R., 6:33924
**Boudrie, R.L.,** *See* Kaellne, J., 6:33999
*See* Morris, C.L., 6:34005
**Bourke, P.J.,** UK modelling of thermal effects on leakage from hard rock depositories, 6:33049 (LBL—11566, pp 14-15)
**Bowen, P.,** *See* Brady, T.M., 6:32891
**Bowen, V.T.,** Pre- and post-dumping investigation for inauguration of new low-level radioactive waste dump sites, 6:33034
**Bowers, D.A.,** *See* Ruester, D.E., 6:34083
**Bowers, R.L.,** Core collapse, bounce and shock propagation, 6:33944
**Bowman, K.O.,** Estimation problems associated with the Weibull distribution, 6:34194 (ORNL/CSD—79)
*See* Shenton, L.R., 6:34199
**Bowman, M.G.,** *See* Jones, W.M., 6:33074
*See* Mason, C.F.V., 6:33073
**Boyd, J.B.,** Third-chromosome mutagen-sensitive mutants of Drosophila melanogaster, 6:33861
**Boyd, R.R.,** *See* Christiansen, J.H., 6:32825
**Boyen, J.L.,** *See* Rodden, R.M., 6:32970
**Bozman, W.R.,** *See* Sparkman, T., 6:33093, 6:33122
**Bradley, E.R.,** *See* Henager, C.H. Jr., 6:33532
**Bradley, R.G.,** *See* Reber, E.E., 6:33062
**Brady, T.M.,** Costs of recontouring abandoned mined land, 6:32891 (ANL/LRP-TM—20, pp 225-241)

**Braga, R.A.,** Very slow M4 transitions and shell-model intruder states in $^{199}$sup(,)$^{201}$Bi, 6:34027
**Brager, H.R.,** Comparison of the swelling and the microstructural/ microchemical evolution of AISI 316 irradiated in EBR-II and HFIR, 6:33516 (HEDL-SA—2359)
Damage development and hardening in 14 MeV neutron irradiation of copper alloys at 25°C, 6:33515 (HEDL-SA—2357)
**Braithwaite, W.J.,** *See* Morris, C.L., 6:34005
**Bramlett, L.,** *See* Pacer, J.C., 6:33001
**Brau, C.A.,** *See* Warren, R.W., 6:33648
**Brauer, F.P.,** Environmental concentration and migration of $^{129}$I, 6:33767 (PNL-SA—9140)
**Bray, M.A.,** *See* Griffith, J.M., 6:33332
**Brenizer, J.S. Jr.,** Soil homogeneity evaluation by radionuclide tracer breakthrough curve interpretation, 6:33819 (CONF-800433—, pp 742-752)
**Brennan, R.J.,** *See* Diaz-Tous, I.A., 6:32925
**Brenner, D.S.,** *See* Burrows, T.W., 6:34201
**Brenner,D.S.,** *See* Walters, W.B., 6:34017
**Brewer, J.H.,** *See* Clawson, C.W., 6:33957
**Brian, B.W.,** *See* Brockington, J.W., 6:32831
**Brigham, W.E.,** *See* Gobran, B.D., 6:32986
**Bright, G.R.,** Minicomputer and computer numerical control maintenance, 6:33643 (Y/IA—152)
**Brink, D.M.,** Role of the attractive nuclear potential in determining reaction cross sections, 6:34033
**Brinkman, D.W.,** Design properties of coal liquids: edited workshop proceedings, 6:32807 (CONF-810381—)
**Britt, D.,** Proceedings: workshop on cycling and effects of toxic substances, Carmel, California, October 26-29, 1980, 6:33794 (EPRI-EA—1988)
**Britt, H.C.,** *See* Christensen, P.R., 6:34016
**Brockington, J.W.,** Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)
**Brodsky, S.J.,** Fundamental tests and measures of the structure of matter at short distances, 6:33989 (SLAC-PUB—2776)
**Brodzinsky, R.,** Activated carbon catalyzed oxidation of aqueous S(IV) species, 6:33747 (LBL—11986, pp 5.1-5.4)
*See* Benner, W., 6:33748
**Bromberg, L.,** Effect of impurities and ripple upon power regulation in self-sustained tokamaks, 6:34055 (CONF-801011—(Vol.3), pp 1066-1073)
**Bronisz, S.E.,** Space nuclear safety and fuels program. Progress report, 6:33071 (LA—8904-PR)
Space nuclear safety and fuels program. Progress report, April 1981, 6:33072 (LA—8968-PR)
**Brooks, A.L.,** Electromagnetic launcher: a new weapon, 6:33641 (UCRL—85877)
**Broutman, L.J.,** *See* Diamant, Y., 6:33607
**Brown, B.S.,** Radiation effects in superconducting fusion-magnet materials, 6:33537
**Brown, D.P.,** Cycle design for the ISABELLE helium refrigerator, 6:33679 (BNL—30006)
Design of 24.8-kW, 3.8 K cryogenic system for ISABELLE, 6:33684 (BNL—30013)
*See* Bamberger, J.A., 6:33683
*See* Werner, A.P., 6:33682
*See* Wu, K.C., 6:33681
**Brown, R.E.,** *See* Flynn, E.R., 6:34021
*See* Ohlsen, G.G., 6:33998
**Brownell, J.H.,** Ultra-high-density plasma experiments: MHD simulations, 6:34062 (LA-UR—81-2572)
**Bruce, J.L.,** Southern Carson Sink study area, 6:33217 (DOE/NV/10039—3, pp 161-189)
*See* Trexler, D.T., 6:33207
**Bruemmer, S.M.,** *See* Jones, R.H., 6:33531
**Brunke, J.H.,** *See* Hasibar, R.M., 6:33283
**Brunsden, B.S.,** Optical device with conical input and output prism faces, 6:33705
**Buchler, J.R.,** Supernova explosions - the role of a Rayleigh-Taylor instability, 6:33946
**Buck, J.W.,** *See* Sandusky, W.F., 6:33243
**Buckler, R.J.,** *See* Tassicker, O.J., 6:32932
**Buckman, R.W. Jr.,** Lightweight concrete materials and structural systems for water tanks for thermal storage. Final report, 6:33372 (COO—4703-26)
**Buhl, F.,** *See* Curtis, R., 6:33455
**Bundy, J.J.,** Design of the TFTR Zr/Al surface pumping panels, 6:34161 (CONF-801011—(Vol.3), pp 1009-1016)
**Burch, M.B.,** *See* Mattice, J.S., 6:33915
**Burgess, A.S.,** Modeling of groundwater flow in fractured rocks for radioactive waste repository studies, 6:33928 (LBL—11566, pp 65-76)
**Burke, D.G.,** Nuclear structure of $^{161}$sup(,)$^{163}$Ho studied with the (t vector,$\alpha$) reaction, 6:34022
**Burleson, R.R.,** Digital control of machine tools, 6:33642 (Y—2227)
**Burlison, J.S.,** List of DOE radioisotope customers with summary of radioisotope shipments, FY 1980, 6:33068 (PNL—3839)
**Burney, G.A.,** *See* Gray, L.W., 6:33572
**Burnier, R.C.,** Gas-phase reactions of $Fe^+$ with ketones and ethers, 6:33960
**Burns, A.L.,** *See* Chartier, V.L., 6:33286
**Burns, E.J.T.,** *See* Hauer, A., 6:34184
**Burns, W.A.,** *See* Smits, R.G., 6:33637
**Burr, R.L.,** *See* Clark, R.A., 6:33329
**Burrows, T.W.,** Minutes of the fifth annual meeting of the panel on reference nuclear data, 6:34201 (BNL-NCS—51364)
**Burtner, D.R.,** *See* Miller, G.E., 6:33778
**Busch, G.E.,** *See* Charatis, G., 6:34061
**Busch, R.A.,** *See* Rowe, D.S., 6:34139
**Butler, N.,** *See* Wade, J.E., 6:33237
**Butz, T.R.,** Stream sediment detailed geochemical survey for Date Creek Basin, Arizona, 6:33006 (GJBX—243-81)
**Butzek, D.,** *See* Zatz, I.J., 6:34135
**Byrd, G.D.,** *See* Burnier, R.C., 6:33960

## C

**Cahn, R.N.,** Bounds on the masses of neutral generation-changing gauge bosons, 6:33979
**Cain, W.C.,** Environmental R and D needs for advanced power plants, 6:32895
**Cairns, A.J.,** *See* Lane, G.J., 6:33660
**Caldwell, C.S.,** Survey of lithium compounds for tritium breeding applications, 6:34133 (CONF-801011—(Vol.2), pp 1770-1781)
**Caldwell, S.E.,** *See* Gentry, R.A., 6:33619
**Callaway, S.,** *See* Bavinger, B.A., 6:32967
**Calloway, N.E.,** In-vessel inspection before head removal: TMI II: Phase I. (Conceptual development), 6:33353 (GEND—010-Vol.1)
**Camara, E.H.,** *See* O'Sullivan, J.B., 6:33443
**Campbell, A.C.,** *See* Gee, G.W., 6:33804
**Campbell, K.,** *See* Bolivar, S.L., 6:33014
**Campbell, M.,** *See* Leipuner, L.B., 6:33688
**Campbell, M.K.,** *See* Morse, W.M., 6:33965
**Campoy, L.,** *See* Fazzolare, R., 6:33167
**Candy, J.V.,** Safeguards design for a plutonium concentrator: an applied estimation approach, 6:33058
**Cannon, N.S.,** High rate transient mechanical properties of unirradiated fast reactor cladding, 6:33358 (HEDL-SA—2288-S)
**Canon, R.M.,** Evaluation of potential processes for recovery of metals from coal ash. Final report, 6:33469 (EPRI-CS—1992(Vol.1))
**Caramella-Crespi, V.,** *See* Maggi, L., 6:33818
**Card, H.C.,** *See* Panayotatos, P., 6:33565
**Caretta, A.,** *See* Schneider, H., 6:34088
**Carey, D.I.,** Dragline reclamation of abandoned contour mines, 6:32890 (ANL/LRP-TM—20, pp 205-221)
**Carlin, J.,** *See* Hastlett, J., 6:33246
**Carlson, B.V.,** Multiple Coulomb polarization potential for heavy ion scattering, 6:34025
**Carlson, C.E.,** Two-photon contributions to lepton production in pp scattering, 6:33980
**Carlson, D.E.,** *See* Moore, A.R., 6:33117, 6:33118
**Carlson, G.A.,** Design of tandem mirror reactors with thermal barriers, 6:34148 (CONF-801011—(Vol.3), pp 815-824)
**Carpenter, D.A.,** *See* Vandermeer, R.A., 6:33534
**Carpenter, L.K.,** Controlled combustion of a varying low-btu coal-derived gas, 6:32952
**Carpenter, R.,** Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)
**Carpenter, S.G.,** Autoradiographic technic for Plutonium, Polonium, and Promethium tissue sections, 6:33857
**Carraro, G.,** *See* Berthelot, C., 6:33792, 6:33810
**Carrasco, A.,** *See* Adler, H.I., 6:33898
**Carroll, W.,** *See* Andersson, B., 6:33172
*See* Grimsrud, D., 6:33451
**Carson, J.,** *See* Moaveni, M., 6:32929

**Carson, J.W.,** Discussion: measuring the effectiveness of FCA, 6:32928 (EPRI-WS—79-236, pp 2.92-2.102)
*See* Womack, W., 6:32926
**Carter, H.K.,** *See* Pegg, D.J., 6:33955
*See* Toth, K.S., 6:34024
**Carter, L.L.,** *See* Mann, F.M., 6:34173
**Carty, R.H.,** *See* Schreiber, J.D., 6:33078
**Casamajor, A.B.,** Engineering evaluation of Riola containment, 6:33719 (UCID—19164)
**Cascio, E.L.,** Cost control for offshore structures, 6:33665
**Case, C.W.,** Appropriate energy technology in the US Pacific territories, 6:33389
**Caskey, G.R. Jr.,** Tritium autoradiography, 6:33654 (DP-MS—81-12)
**Casper, G.,** *See* Prater, L.S., 6:33374
**Casten, R.F.,** *See* Davidson, W.F., 6:34023
**Cates, M.,** *See* Drake, D.M., 6:34007
**Catto, P.J.,** *See* Myra, J.R., 6:34070
**Cawley, C.N.,** Environmental radionuclide concentrations: statistical model to determine uniformity of distribution, 6:33823 (CONF-800433—, pp 45-53)
**Chambers, E.S.,** *See* Helm, F.H. Jr., 6:33714
**Chan, P.C.H.,** *See* Sah, C.T., 6:33123
**Chan, S.H.,** Experimental design for reflection measurements of highly reactive liquid or solid substances with application to liquid sodium, 6:33345 (DOE/ET/37227—T2)
Surface radiation properties of $ThO_2$ and other reactor materials, 6:33346 (DOE/ET/37227—T4)
*See* Kocamustafaogullari, G., 6:33344
**Chance, M.S.,** *See* Rewoldt, G., 6:34068
**Chang, J.Y.,** Deuterium retention in titanium alloys exposed in PLT, 6:34132 (CONF-801011—(Vol.2), pp 1764-1769)
**Chang, L.K.,** TCLUST1: a computer program for analysis of intersubassembly heat transfer in an LMFBR, 6:33301 (ANL—81-18)
**Chang, S.,** Importance of soot particles and nitrous acid oxidizing $SO_2$ in atmospheric aqueous droplets, 6:33750 (LBL—11986, pp 5.10-5.12)
*See* Brodzinsky, R., 6:33747
*See* Cohen, S., 6:33752
*See* Gomiscek, S., 6:33751
*See* Oblath, S., 6:33749
**Chang, S.G.,** Kinetics of reactions in a wet flue-gas simultaneous desulfurization and denitrification system, 6:32878 (LBL—13063)
**Chao, A.W.,** Beam emittance growth caused by transverse deflecting fields in a linear accelerator, 6:33666
**Chapin, D.L.,** Parametric systems analysis for tokamak hybrid reactors, 6:34116 (CONF-801011—(Vol.2), pp 1444-1454)
*See* Berwald, D.H., 6:34115
**Charatis, G.,** Laser heated gas-jet: a soft x-ray source, 6:34061 (KMSF-U—1109)
**Charleston, J.,** *See* Reid, M.A., 6:33441
**Charlson, R.,** *See* Sadler, M., 6:33754
**Chartier, V.L.,** Formulas for predicting audible noise from overhead high voltage ac and dc lines, 6:33287
Investigation of corona and field effects of ac/dc hybrid transmission lines, 6:33286
**Chastain, S.A.,** Technique for preparation of prototypic fast test reactor mixed-oxide fuel pins for ceramography and metallography, 6:33309 (HEDL-SA—2333-FP)
**Chatt, A.,** Environmental trace element analysis using short-lived nuclides, 6:33732 (CONF-800433—, pp 231-246)
**Chehroudi, M.T.,** *See* Cawley, C.N., 6:33823
**Chen, F.,** *See* Zhang, X., 6:33645
**Chen, F.C.,** *See* Golshani, A., 6:33156
**Chen, G.L.,** *See* Ross, D.W., 6:34057
**Chen, M.C.,** *See* Kamil, H., 6:33032
**Chen, W.L.,** Parametric study of multichannel molten cladding motion under unprotected loss-of-flow accident conditions in LMFBR's, 6:33366
**Chen, Z.,** *See* Liu, S., 6:32975
**Cheng, E.T.,** Blanket and shield nucleonic considerations for the Field-Reversed Mirror Small Reactor, 6:34093 (CONF-801011—(Vol.1), pp 430-438)
Design considerations for high-temperature synthetic fuel production fusion reactors, 6:33064 (CONF-801011—(Vol.2), pp 1622-1629)
*See* Wong, C.P.C., 6:34146
**Cheng, K.Y.,** *See* Lewis, R.I., 6:33249
**Cheng, T.C.,** Analysis of short-term reactor cavity transient, 6:33342 (CONF-810606—74)
Contamination flashover of HVDC insulators. Final report, 6:33282 (EPRI-EL—2016)
**Cheng, Y.S.,** Collection efficiencies of a point-to-plane electrostatic precipitator, 6:33704
**Cherdack, R.N.,** *See* Gordon, J.D., 6:34102
**Chern, W.S.,** *See* Maddigan, R.J., 6:33427
**Cherne, J.,** Solar production of industrial process steam: TRW/ORE-Ida potato processing project, Phase I. Final report, 6:33163 (DOE/CS/32197—T1)
**Cherry, W.B.,** *See* Orrison, L.H., 6:33876
**Chester, R.O.,** *See* Begovich, C.L., 6:33889
**Chestnut, R.P.,** *See* Christensen, P.R., 6:34016
**Cheung, H.,** *See* Helm, F.H. Jr., 6:33714
*See* Lowry, W.E., 6:33044
**Cheung, T.T.P.,** *See* Murphy, P.D., 6:33582
**Chew, G.F.,** Topological theory of electric charge, 6:33982
**Chhabildas, L.C.,** Dynamic shear-wave velocity measurements using interferometric techniques, 6:33964 (SAND—81-1135C)
Time-resolved wave profile measurements in copper to Megabar pressures, 6:33533 (SAND—81-1358C)
**Chiang, C.C.,** *See* Mukunda, N., 6:34049
**Chien, N.K.,** *See* Christensen, E.R., 6:33796
**Chin, B.A.,** *See* Lovell, A.J., 6:33535
*See* Puigh, R.J., 6:33517
**Choi, C.K.,** *See* Sutton, W.R., 6:34052
**Chou, T.S.,** *See* Halama, H.J., 6:33630
**Chou, Y.T.,** *See* Thadani, V., 6:33499
**Chowaniec, C.,** *See* Clark, J., 6:33255, 6:33256
**Christensen, E.R.,** Model for Pb-210 in sediments influenced by mixing and compaction, 6:33796 (CONF-800433—, pp 135-146)
**Christensen, L.R.,** Models for forecasting energy use in the US farm sector. Final report, 6:33470 (EPRI-EA—1956(Vol.1))
**Christensen, M.,** *See* Craig, P., 6:33399
**Christensen, N.T.,** Utilization of waste heat from major transformer substations. Volume 1. Generic study. Final report, 6:33477 (EPRI-EM—1968(Vol.1))
Utilization of waste heat from major transformer substations. Volume 2. Site-specific study. Final report, 6:33478 (EPRI-EM—1968(Vol.2))
**Christensen, P.R.,** Gamma-ray multiplicity moments from $^{86}Kr$ reactions on $^{144}sup(,)^{154}Sm$ at 490 MeV, 6:34016
**Christensen, R.M.,** Nonlinear theory of viscoelasticity for application to elastomers, 6:33554
**Christensen, U.,** *See* Jardin, S.C., 6:34066
**Christian, O.W.,** ORELA electron guns, 6:33672 (ORNL/TM—7886)
**Christiansen, J.H.,** Applicability of the industrial source complex dispersion model to the SRC-I Demonstration Plant, 6:32825 (DOE/OR/03054—3, pp 71-88)
**Christoffersen, R.E.,** *See* Petke, J.D., 6:33609
**Chu, E.K.,** *See* Krill, W.V., 6:32945
**Chu, M.S.,** Current driven nonideal instability in a force-free toroidal plasma, 6:34059 (GA-A—16418)
**Chum, H.L.,** Review of thermally regenerative electrochemical systems, 6:33442 (SERI/TR—332-416-Vol.2)
*See* Reed, T.B., 6:33121
**Chung, C.,** *See* Walters, W.B., 6:34017
**Churchill, T.L.,** *See* Willenberg, H.J., 6:34152
**Chynoweth, D.P.,** *See* Srivastava, V.J., 6:33084
**Cindro, N.,** *See* Drake, D.M., 6:34007
**Citrolo, J.,** Special features of the TFTR vacuum vessel, 6:34164 (CONF-801011—(Vol.3), pp 1034-1037)
**Cizewki, J.A.,** *See* Girshick, F., 6:34026
**Cizewski, J.A.,** *See* Burke, D.G., 6:34022
*See* Flynn, E.R., 6:34021
**Claiborne, H.C.,** *See* Beyerlein, S.W., 6:33043
**Clark, G.W.,** *See* Tennery, V.J., 6:33546
**Clark, J.,** Entrained gasification combined-cycle control study. Volume 2. Results. Final report, 6:33255 (EPRI-AP—1422-Vol.2)
Entrained gasification combined-cycle control study. Volume 3: model descriptions. Final report, 6:33256 (EPRI-AP—1422-Vol.3)
**Clark, K.,** *See* Dybeck, R., 6:33264
**Clark, M.L.,** *See* DeFord, H.S., 6:33703
**Clark, R.A.,** Method for controlled stress corrosion cracking in nonsensitized inconel 600 tubing, 6:33329
**Clarke, N.M.,** *See* Fulmer, C.B., 6:34013
**Clausing, R.E.,** High-speed photographic observation of plasma-limiter interactions in ISX-B, 6:34056 (CONF-810831—52)
**Clawson, C.W.,** Low temperature diffusion of positive muons in copper, 6:33957 (LA-UR—81-2473)
**Clayton, N.L.,** *See* Setlow, J.K., 6:33858
**Clear, R.,** *See* Berman, S., 6:33454
**Cleary, P.,** *See* Rosenfeld, A., 6:33456

**Cleaver, J.E.,** Sensitivity of excision repair in normal human, xeroderma pigmentosum variant and Cockayne's syndrome fibroblasts to inhibition by cytosine arabinoside, 6:33893
**Cleland, J.W.,** Electrical property studies of oxygen in Czochralski-grown neutron-transmutation-doped silicon, 6:34047 (CONF-800877—3)
**Clem, R.,** *See* Gomiscek, S., 6:33751
**Clemenson, M.,** Determination of carbon in atmospheric aerosols by deuteron-induced nuclear reactions, 6:33579 (LBL—11986, pp 5.35-5.37)
**Clements, W.,** *See* Olness, D.U., 6:32842
**Clink, G.L.,** Proton and carbon-13 NMR study of stockpile-aged LX-09, 6:33711 (MHSMP—81-37)
**Cloutman, L.D.,** Numerical simulation of the countercurrent flow in a gas centrifuge, 6:33016 (LA-UR—81-1821)
**Cobbs, J.C.,** *See* Maddigan, R.J., 6:33427
**Cogan, B.C.,** Full amplitude models of 15 day Cepheids, 6:33933
**Cohen, I.,** Why masses and magnetic moments satisfy naive quark model predictions, 6:33990
**Cohen, R.H.,** *See* Lichtenberg, A.J., 6:33951
**Cohen, S.,** Role of fly ash in the catalytic oxidation of $SO_2$, 6:33752 (LBL—11986, pp 5.15-5.18)
**Cohen, S.A.,** Flux of hydrogen from tokamak devices, 6:34051 (CONF-801011—(Vol.1), pp 61-66)
**Cohn, D.R.,** *See* Bromberg, L., 6:34055
**Cohn, S.H.,** *See* Ellis, K.J., 6:33905
*See* Ettinger, K.V., 6:33868, 6:33906
**Coico, P.,** *See* Hurlbut, F.C., 6:33626
**Cole, C.R.,** *See* Gupta, S.K., 6:33053
**Cole, P.W.,** Core helium flash, 6:33941
**Coleman, M.C.,** Creep damage accumulation during thermal cycling of a transition joint, 6:33326 (R/M/R—207)
**Colgate, S.A.,** Ion chamber gamma burst detector, 6:33936 (LA-UR—81-2591)
Supernova hydrodynamics, 6:33935 (LA-UR—81-2575)
*See* Buchler, J.R., 6:33946
**Colgrove, S.G.,** Liquid-liquid chromatography fractionation of organic compounds in complex mixtures: application to automobile exhaust, 6:33575 (IS-T—914)
**Colijn, H.,** In-plant coal handling, 6:32934 (EPRI-WS—79-236, pp 7.1-7.36)
**Collins, C.J.,** Model compound study of the mechanism of $sp^2$-$sp^3$ carbon-carbon cleavage during the reduction of coals, 6:33606 (CONF-810914—4)
**Collins, F.M.,** *See* Pepper, W.B., 6:33639
**Collins, H.D.,** Focused line source linear array holography using a three dimensional computer reconstruction system, 6:33330
**Collins, L.W.,** Catalytic decomposition of potassium perchlorate, 6:33597
**Colton, E.,** Particle trajectories in quadrupole fringe fields, 6:33667
**Colyer, D.,** *See* Keeney, T.A., 6:32886
**Combs, J.F.,** *See* Kessler, R.C., 6:32854
**Compton, R.N.,** Photodetachment cross sections for $He^-$ ($^4P^o$), 6:33961
**Conant, M.A.,** Politics of oil and gas, 6:33412 (EPRI-WS—79-182, pp 3.8.1-3.8.4)
**Conn, R.W.,** Design studies of commercial magnetic fusion reactors, 6:34170 (CONF-801011—(Vol.3), pp 1205-1216)
**Connick, R.E.,** Processes and techniques, 6:32839 (LBL—12000, pp 334-378)
**Conrado, C.L.,** *See* Robison, W.L., 6:33828
**Consalus, G.,** *See* Brady, T.M., 6:32891
**Conway, J.G.,** *See* Edelstein, N.M., 6:33620
*See* Van Deurzen, C.H.H., 6:33603
**Cook, C.E.,** *See* Enever, J.R., 6:32918
**Cook, F.X.,** *See* Hill, F.E., 6:32906
**Cook, L.M.,** Development of uv-transparent fluorophosphate glass. Final report, July 10, 1980-January 10, 1981, 6:33564 (UCRL—15375)
**Cooke, R.A.,** Simulation of coal conversion reactor environments, 6:32851
**Cooper, J.F.,** Development of the aluminum-air battery for electric vehicle applications, 6:33492 (UCRL—86560)
Preliminary design and analysis of aluminum-air cells providing for continuous feed and full utilization of anodes, 6:33380 (UCID—19178)
**Cooper, R.,** *See* Bailey, V., 6:34168
**Cooper, R.K.,** *See* Jackson, J.A., 6:33707
**Cordell, K.R.,** *See* Dennis, L.C., 6:34003
**Corkern, W.D.,** *See* Smith, D.D., 6:33802
**Correll, F.D.,** *See* Ohlsen, G.G., 6:33998
**Cost, J.R.,** Structural relaxation rates in amorphous Metglas alloys $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_{80}B_{80}$, 6:33523 (LA-UR—81-2444)
**Costin, L.S.,** Failure surface model for oil shale, 6:32993 (SAND—81-1128)
**Cotter, S.J.,** *See* Berger, C.D., 6:33361
**Cottingame, W.B.,** *See* Morris, C.L., 6:34005
**Coughlin, R.W.,** Electrochemical gasification of coal--simultaneous production of hydrogen and carbon dioxide by a single reaction involving coal, water, and electrons, 6:32850
**Counihan, R.H.,** Energy conservation and the rental housing market, 6:33396
**Cox, A.J.,** Economics of photovoltaics in the commercial, institutional, and industrial sectors, 6:33130 (MIT-EL—80-008)
*See* Dinwoodie, T.L., 6:33131
**Cox, A.N.,** RR Lyrae and BL Herculis variables, 6:33939
*See* Cogan, B.C., 6:33933
*See* Cox, J.P., 6:33943
*See* Hodson, S.W., 6:33942
*See* Newman, M.J., 6:33948
*See* Starrfield, S.G., 6:33949
**Cox, D.N.,** *See* Schmidt, T.R., 6:33338
**Cox, J.P.,** Pulsations of the R Coronae Borealis stars, 6:33943
**Cox, R.H.T.,** Study of the instability of a spoil pile in an open strip coal mine, 6:32912
**Coxe, D.H.,** *See* Adams, E.E., 6:33155
**Coyne, J.J.,** *See* Burrows, T.W., 6:34201
**Craig, P.,** Distributed energy systems in California's future: Interim report, Volume I, 6:33399 (LBL—6831-Rev.)
**Cramer, J.L.,** *See* Helm, F.H. Jr., 6:33714
**Cramer, M.,** Solar energy system performance evaluation: Cathedral Square, Burlington, Vermont, January 1980-December 1980, 6:33189 (SOLAR/1060—81/14)
**Crawford, D.L.,** *See* Antai, S.P., 6:33872
**Crawford, G.,** *See* Enever, J.R., 6:32918
**Crawford, G.R.,** *See* Enever, J.R., 6:32917, 6:32920, 6:32921
**Crawford, J.H. Jr.,** Equilibrium between type I and type II $M^{3+}$-$F_1^-$ complexes in alkaline earth fluorides, 6:33601
**Crawford, L.W.,** *See* Roy, G.D., 6:33437
**Creasey, J.W.,** *See* Enever, J.R., 6:32918
**Creed, K.E.,** Aging of Adiprene L-100/butanediol/trimethylolpropane stocks, 6:33069 (GEPP-TIS—587)
**Creedon, L.,** *See* Wong, C.P.C., 6:34146
**Creedon, R.L.,** Structural design tolerance of radiation swelling: a first step, 6:34131 (CONF-801011—(Vol.2), pp 1747-1753)
**Cremer, G.M.,** Hot dry rock geothermal energy development program. Annual report, fiscal year 1980, 6:33228 (LA—8855-HDR)
**Cresap, R.L.,** *See* Hauer, J.F., 6:33288
**Cress, E.A.,** *See* Blank, M.L., 6:33864
**Creutz, M.,** Numerical studies of gauge field theories, 6:33987 (BNL—29840)
Phase transitions and variant actions in lattice gauge theory, 6:33986 (BNL—29823)
**Cronauer, D.C.,** Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Annual progress report, February 1980-February 1981, 6:32834 (DOE/PC/30080—4)
**Crossley, F.R.E.,** Assessment of wood-chipping machinery for harvesting non-commercial timber in New England, 6:33106 (DOE/ET/20077—T1)
**Crotzer, M.E.,** Cost of generating tritium internal and external to a tokamak hybrid reactor, 6:34099 (CONF-801011—(Vol.1), pp 535-542)
**Crow, W.,** *See* Adler, H.I., 6:33898
**Crowe, K.M.,** *See* Clawson, C.W., 6:33957
**Cullen, T.L.,** *See* Paschoa, A.S., 6:33813
**Cullingford, H.S.,** *See* Reupke, W.A., 6:34123
**Culver, M.H.,** *See* Wells, J.W., 6:33265
**Cunniff, R.A.,** New Mexico State University campus geothermal demonstration project: an engineering construction design and economic evaluation. Final technical report, February 25, 1980-April 24, 1981, 6:33233
**Cunningham, D.,** *See* Enever, J.R., 6:32920
**Curtis, R.,** DOE-2.1 building energy analysis group, 6:33455 (LBL—11985, pp 4.45-4.49)
**Cwik, M.J.,** Analytical overview of practices, costs, and interdisciplinary relationships and trade-offs for reclamation planning in the coal industry with applications to non-coal, 6:32888 (ANL/LRP-TM—20, pp 169-187)

## D

**D'Acierno, J.,** Analysis of gasoline supply for the United States during the 1979 shortage, 6:33398 (BNL—51330)
**Dahl, O.I.,** *See* Kennett, R.G., 6:33972
**Dalder, E.N.C.,** Evaluation of shielded metal arc and flux cored metal arc

welding consumables for fabrication of stainless steel magnet cases for 4K service, 6:33640 (UCRL—85564)
**Daniels, J.I.,** Environmental, health, safety, and socioeconomic impacts associated with oil recovery from tar-sand deposits in the United States, 6:32998 (UCRL—53197)
**Daniels, R.E.,** TFTR control and monitoring system (CICADA), 6:34159 (CONF-801011—(Vol.3), pp 996-1001)
**Daniels, W.R.,** *See* Thompson, J.L., 6:33797
**Danyluk, S.,** Failure analysis of coal-gasification pilot plant components, 6:32855
**Das, P.K.,** Intramolecular energy transfer in polymers containing benzoyl and naphthalene moieties, 6:33613
*See* Raghavan, N.V., 6:33618
**Das Gupta, A.K.,** *See* Filby, R.H., 6:33825
**Daubert, R.L.,** Automated remote positioning and examination of FFTF reactor power characterization dosimeters, 6:33336 (HEDL-SA—2312-FP)
**Davidson, J.W.,** Long-term toxicity reduction using an imploding liner reactor as a waste transmuter, 6:33067 (CONF-801011—(Vol.2), pp 1643-1650)
**Davidson, W.F.,** Identification of all intrinsic excitations below 2 MeV in $^{168}$Er, 6:34023
**Davies, K.,** *See* Packer, L., 6:33854
**Davies, N.A.,** Status of tokamak confinement experiments, 6:34078 (CONF-801011—(Vol.1), pp 52-59)
**Davis, A.,** Variable capacity compressor controller, 6:33448 (DOE/CS/35224—T1)
**Davis, B.W.,** *See* Lowry, W.E., 6:33044
**Davis, C.B.,** *See* Hsu, M., 6:33341
**Davis, J.,** *See* Kaellne, J., 6:33999
**Davis, J.W.,** Materials application in neutral beam injectors and RF heating systems, 6:34137 (CONF-801011—(Vol.2), pp 1825-1832)
**Davis, S.P.,** *See* Van Deurzen, C.H.H., 6:33603
**Davis, W.E.,** Comparison of regional scale effects of in-cloud conversion of $SO_2$ to $SO_4$/sup =/ in an eight-layer diabatic model with a single-layer model, 6:33760 (PNL-SA—8432)
**Davis, W.M.,** *See* Bobbie, R.J., 6:33917
**Daw, C.S.,** Coal and limestone feed testing for atmospheric fluidized bed combustion, 6:32948 (ORNL/TM—7724)
**Day, C.T.,** *See* Smits, R.G., 6:33637
**Day, D.L.,** *See* Ochs, T., 6:33192
**Dayananda, M.A.,** Zero-flux planes and flux reversals in multicomponent diffusion. Progress report, January 1, 1981-August 31, 1981, 6:33508 (DOE/ER/10814—1)
**De Jonghe, L.C.,** Improved beta-alumina electrolytes for advanced storage batteries, 6:33379 (LBL—12000, pp 519-523)
**de Lancey, K.,** Radiochemical-NAA studies of biological samples in connection with marine production of petroleum, 6:33817 (CONF-800433—, pp 662-670)
**De Reu, L.,** *See* Maenhaut, W., 6:33844
**De Roose, J.,** *See* Maenhaut, W., 6:33844
**De Vries, R.M.,** *See* Peng, J.C., 6:34006
**Deadmore, D.J.,** *See* Lowell, C.E., 6:33509
**Deady, M.A.,** *See* Suidan, M.T., 6:32867
**Dean, A.,** *See* Enever, J.R., 6:32918
**Dean, A.K.,** *See* Enever, J.R., 6:32920, 6:32921
**Dean, N.L. Jr.,** Institutional obstacles to industrial cogeneration, 6:33393
**Deaver, F.K.,** *See* Turner, W.D., 6:33124
**Dees, S.B.,** *See* Orrison, L.H., 6:33876
**DeFord, H.S.,** Stabilized aerosol generator, 6:33703
**DeFreece, D.A.,** Utility impact on STARFIRE design, 6:34166 (CONF-801011—(Vol.3), pp 1088-1095)
**Deininger, F.W.,** *See* Foley, G.F., 6:32874
**Del Grande, N.K.,** Airborne and field-temperature surveys compared at Long Valley KGRA, California, 6:33222 (UCRL—86148)
**Delgado, R. Jr.,** 8 x 8 fuel surveillance program: pre-irradiation characterization, Monticello fuel assembly, December 1974, 6:33291 (DOE/ET/34031—1)
*See* Masand, A.C., 6:33292
**Deligiannis, K.S.,** Combustion turbine combined-cycle R and D project priority analysis. Final report, 6:33260 (EPRI-AP—1943)
**DelVecchio, R.M.,** Calculations of DT fill times and time-temperature behavior during injection for some representative ICF pellets, 6:33063 (CONF-801011—(Vol.1), pp 167-172)
**Denham, D.H.,** Radiological planning guide for DOE decommissioning operations, 6:33057 (PNL-SA—9262)
**Dennis, L.C.,** Search for resonances in $^{12}C(^{9}Be,\alpha)^{17}O$, 6:34003
**Denpree, R.G.,** *See* Cole, P.W., 6:33941
**Denton, L.,** *See* Clark, J., 6:33255, 6:33256
**Derby, G.K.,** Economic considerations of reclaiming abandoned tailings ponds and dams, 6:32892 (ANL/LRP-TM—20, pp 243-257)
**Dering, J.P.,** *See* Richardson, J.H., 6:33584
**Derrick, M.,** Study of the reaction $\nu n \rightarrow \nu p \pi^-$, 6:33973
**DeSilva, K.N.,** *See* Chatt, A., 6:33732
**Despain, K.,** Low-mass evolution from He ignition to beyond the horizontal branch, 6:33940
**Despres, G.,** Prospects for diversifying sources of imported oil and gas supplies, 6:33407 (EPRI-WS—79-182, pp 3.2.1-3.2.7)
**Desrosiers, A.E.,** *See* Smith, M.L., 6:33362
**Desrosiers, R.,** *See* Reed, T.B., 6:33121
**Deutscher, S.B.,** *See* Richardson, J.H., 6:33614
**Devereux, O.F.,** *See* Cooke, R.A., 6:32851
**Di Giacomo, N.J.,** *See* Peng, J.C., 6:34006
**Diamant, Y.,** Effect of network structure on moisture absorption of epoxy resins, 6:33607
**Diaz-Tous, I.,** *See* Maloney, K.L., 6:32935
**Diaz-Tous, I.A.,** Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)
**DiCenzo, S.B.,** *See* Betts, R.R., 6:34011
**Dickson, P.W.,** *See* Riley, D.R., 6:33302
**Dieboid, J.,** *See* Reed, T.B., 6:33121
**Diesendorf, M.,** Integration of wind power into Australian electricity grids without storage: a computer simulation, 6:33238
**Dietz, R.H.,** Solar power satellite microwave transmission and reception, 6:33133 (NASA-CP—2141)
**Dillard, J.W.,** *See* Raines, W.L., 6:33799
**Dimelfi, R.J.,** *See* Kramer, J.M., 6:33365
**Dinwoodie, T.L.,** Cost goals for a residential photovoltaic/thermal liquid collector system set in three northern locations, 6:33097 (MIT-EL—80-028)
Flywheel storage for photovoltaics: an economic evaluation of two applications, 6:33129 (MIT-EL—80-002)
Impact on photovoltaic worth of utility rate and reform and of specific market, financial, and policy variables: a commercial/industrial/institutional sector analysis, 6:33131 (MIT-EL—80-025)
Photovoltaic assisted residence with supplemental battery storage: searching for a complementarity, 6:33126 (MIT-EL—79-016)
**Dissinger, G.R.,** Dynamic simulation of methanation reactors, interstage heat exchangers, and controllers, 6:32852
**DiTomasso, E.,** *See* Roberts, J.G., 6:33869
**Divadeenam, M.,** Ni elemental neutron induced reaction cross-section evaluation, 6:34038 (BNL-NCS—51346)
**Djahanguiri, F.,** *See* Kamil, H., 6:33032
**Dod, R.,** *See* Gundel, L., 6:33755
**Dodd, D.J.,** *See* Orrison, L.H., 6:33876
**Dodge, M.M.,** *See* Gregory, A.R., 6:32990
**Doering, R.R.,** *See* Dennis, L.C., 6:34003
**Doherty, T.J.,** Reservoir stability studies, 6:33370 (PNL-SA—9782)
**Donaldson, A.B.,** *See* Fox, R.L., 6:32971
**Donaldson, D.,** *See* Smith, M.L., 6:33362
**Dorn, H.C.,** Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, April 1981-June 1981, 6:32833 (DOE/PC/30041—T6)
**Doss, J.D.,** Technique for the selective heating of corneal stroma, 6:33870
**Dougan, R.J.,** *See* Hulet, E.K., 6:34030
**Downing, D.L.,** *See* Rao, M.A., 6:33465
**Drake, D.M.,** Gross structure and resonant behavior of $^{14}C + ^{14}C$ elastic scattering, 6:34007
*See* Drosg, M., 6:33695
**Dreesen, D.R.,** Biogeochemistry of uranium mill wastes program overview and conclusions, 6:33035 (LA—8861-UMT)
**Driemeyer, D.,** *See* Gilligan, J.G., 6:34149
**Drosg, M.,** Contribution of carbon interactions to the neutron counting efficiency of organic scintillators, 6:33695
**Dudley, V.E.,** Performance testing of the TOLTEC TI-410 concentrating solar collector, 6:33195 (SAND—81-0369)
**Dudziak, D.J.,** *See* Bathke, C.G., 6:34165
**Duffey, R.B.,** *See* Kalra, S.P., 6:33367
**Duguid, J.O.,** Flow in fractured porous media, 6:33051 (LBL—11566, pp 33-36)

**Dugundji, J.,** General review of the MOSTAS computer code for wind turbines, 6:33241 (DOE/NASA/3303—1)
**Dunbavan, M.,** Two-wedge stability analysis based on energy principles, 6:32913
*See* Cox, R.H.T., 6:32912
**Duncan, D.T.,** *See* Headrick, L.A., 6:33919
**Dunwoodie, W.,** *See* Aiken, G., 6:33690
**Dybczynski, R.,** NAA as viewed from the perspective of International Atomic Energy Agency intercomparison tests, 6:33733 (CONF-800433—, pp 296-305)
**Dybeck, R.,** Selective load control for industrial customers, 6:33264 (ORNL/Sub—7399/1)
**Dyer, C.W.,** *See* Poutsma, M.L., 6:32808
**Dyer, P.N.,** *See* Brockington, J.W., 6:32831

## E

**Eagle, R.J.,** *See* Robison, W.L., 6:33828, 6:33829
**Earle, T.C.,** Public perceptions of industrial risks: the context of public attitudes toward radioactive waste, 6:33382 (PNL—3799)
**Easton, C.W.,** *See* Gant, R.E., 6:33479
**Eaton, R.R.,** Importance of including fractures in thermohydrological modeling of flow through porous media, 6:33054 (LBL—11566, pp 115-116)
**Ebra, M.A.,** *See* Bibler, N.E., 6:33028
**Eckels, D.E.,** *See* Haas, W.J. Jr., 6:32861
**Eckerman, K.F.,** *See* Begovich, C.L., 6:33889
**Eckert, E.,** *See* Ochs, T., 6:33192
**Edelson, M.C.,** Application of ICP-AES to the multi-elemental and multi-isotopic analysis of fuel dissolver solutions. Progress report, 6:33059 (IS-M—337)
**Edelstein, N.M.,** Low-energy nuclear sciences, 6:33620 (LBL—12000, pp 381-410)
Nuclear waste management, 6:33589 (LBL—12000, pp 503-512)
**Edesess, M.,** Prospects for investment in solar energy, 6:33091 (SERI/TP—351-508)
**Edwards, J.J.,** Proteins of human semen. I. Two-dimensional mapping of human seminal fluid, 6:33848
**Edwards, M.B.,** Look at the Upper Wilcox Rosita Delta system of South Texas, 6:33209
**Egan, B.,** *See* Ruane, M., 6:33271
**Egger, J.P.,** Comparison of $\pi^+$ and $\pi^-$ elastic and inelastic scattering from $^{52}$Cr at 180 MeV, 6:34014
**Ehmann, W.D.,** INAA studies of normal and diseased human brain, 6:33879 (CONF-800433—, pp 459-469)
*See* Khalil, S.R., 6:33816
**Eidsvik, K.J.,** Estimation of time series models for horizontal wind on the Norwegian west coast, 6:33235
**Eisenhawer, S.W.,** *See* Fox, R.L., 6:32971
**Eisenstadt, M.M.,** PURPA and PV systems, 6:33434
**Elia, G.G.,** *See* Buckman, R.W. Jr., 6:33372
**Ellingson, A.C.,** Guidance for implementing an environmental, safety and health assurance program. Volume 14. Model guidelines for utilizing quality assurance support in environmental, safety and health assurance programs, 6:33921 (SAND—81-0645)
*See* Trauth, C.A. Jr., 6:33920
**Ellingson, W.A.,** Materials technology for coal-conversion processes. Progress report, January-March, 1981, 6:32804 (ANL—81-30)
**Elliott, D.C.,** Thermochemical production of liquids from biomass, 6:33115 (PNL-SA—9246)
**Ellis, A.B.,** *See* Karas, B.R., 6:33105
**Ellis, K.J.,** In vivo measurement of cadmium in an occupationally-exposed population, 6:33905 (CONF-800433—, pp 388-397)
*See* Ettinger, K.V., 6:33868
**Ellis, P.,** Availability of capital for developing photovoltaic markets, 6:33128 (MIT-EL—79-042)
**Ellis-Akovali, Y.A.,** *See* Toth, K.S., 6:34024
**Elmore, J.J. Jr.,** *See* Borg, D.C., 6:33852
**Emerson, L.C.,** *See* Clausing, R.E., 6:34056
**Encinas, M.V.,** *See* Das, P.K., 6:33613
**Endicott, R.D.,** Utility perspective on inertial confinement fusion electric power generating plants, 6:34105 (CONF-801011—(Vol.2), pp 1265-1277)
**Enever, J.,** Initial mathematical modelling study of the relationship between underground working conditions and overlying surface topography with reference to the Western Coalfields, N.S.W., 6:32922
**Enever, J.R.,** Analysis of factors influencing roof stability at Wallsend Borehole Colliery, 6:32918
Application of a roof bolt hole penetrometer to the determination of in situ strength of coal-measure sediments, 6:32917
Emphasis in overseas research on underground coal mining: geomechanical implications, 6:32904 (CSIRO—2)
Example of the use of point load testing and rock-quality designation, 6:32901
Geomechanical considerations related to the choice of a working floor for a proposed longwall development, 6:32921
Mathematical analysis of factors influencing the development of mining-induced fractures around blind-ended openings with particular reference to Leichhardt Colliery, 6:32858 (CSIRO—7)
Stress measurement on the Wambo colliery holding and their interpretation in terms of roof conditions, 6:32920
*See* Warburton, P.M., 6:32905
**Engdahl, J.C.,** *See* Berwald, D.H., 6:34124
**Engel, D.W.,** Experimental determination of anomalous scattering lengths of samarium for thermal neutrons, 6:34018 (BNL—29949)
**England, G.,** Soot formation in synthetic fuel droplets. Third quarterly technical progress report, April 1 to June 30, 1981, 6:33743 (DOE/PC/30298—T3)
**Engle, R.F.,** *See* Ramanathan, R., 6:33421
**Erickson, L.M.,** Free-surface velocity measurements of plates driven by reacting and detonating RX-03-BB and PBX-0404, 6:33715 (UCRL—86372)
**Ermi, A.M.,** *See* Puigh, R.J., 6:33517
**Esch, G.W.,** *See* Hazen, T.C., 6:33877
**Esser, P.D.,** Stability of the lithium waterfall first wall protection concept for inertial confinement fusion reactors, 6:34140 (CONF-801011—(Vol.3), pp 618-627)
**Essling, M.A.,** *See* Toohey, R.E., 6:33892
**Estill, W.b.,** *See* Kramer, C.M., 6:33148
**Ettinger, K.V.,** Feasibility study for the in vivo measurement of silicon and beryllium by nuclear techniques, 6:33868 (CONF-800433—, pp 398-408)
New technique of radiation dosimetry based on lyoluminescence, 6:33838 (CONF-800433—, pp 501-511)
Nuclear magnetic resonance method for observation of ferromagnetic pulmonary contaminants, 6:33906 (CONF-800433—, pp 415-423)
**Evans, J.W.,** Energy storage, 6:33378 (LBL—12000, pp 471-493)
**Evans, M.L.,** NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
**Evans, W.D.,** *See* Fenimore, E.E., 6:33937
**Everitt, K.W.,** *See* Revell, P.S., 6:33245

## F

**Fahey, J.A.,** Crystal structure and stoichiometry of the Ca/sub 2+x/Nd/sub 8-x/(SiO$_4$)$_6$O/sub 2-1/2x/ system, 6:33591 (PNL-SA—9377)
**Failey, M.P.,** *See* Anderson, D.L., 6:33777
*See* Zoller, W.H., 6:33728
**Falco, C.M.,** *See* Schuller, I.K., 6:33566
**Fallert, D.L.,** *See* Kessler, R.C., 6:32854
**Faltens, A.,** Heavy ion induction linacs for ICF, 6:34110 (CONF-801011—(Vol.2), pp 1395-1398)
**Fang, Z.,** Discussions on the main periods and threshold temperature (depth) of oilgeneration in the Songliao basin, 6:32966
**Fanger, H.U.,** Activation-analysis prospects by using a concentric 5 x $10^{12}$ N/S sealed neutron tube combined with a fast rabbit system, 6:33730 (CONF-800433—, pp 195-204)
**Fanucci, J.B.,** *See* Migliore, P.G., 6:33248
**Farooque, M.,** *See* Coughlin, R.W., 6:32850
**Farrell, K.,** Microstructure and tensile properties of heavily irradiated 5052-0 aluminium alloy, 6:33538
**Fassel, V.A.,** *See* Edelson, M.C., 6:33059
*See* Haas, W.J. Jr., 6:32861
**Faust, B.C.,** *See* Hoffmann, M.R., 6:33871
**Faust, C.R.,** Role of numerical models in applications to thermohydrological flow in fracture rock masses, 6:33210 (LBL—11566, pp 87-89)
*See* Mercer, J.W., 6:33375
**Fazio, S.D.,** *See* Bobbie, R.J., 6:33917
**Fazzolare, R.,** Guidebook for solar process-heat applications, 6:33167 (DOE/TIC—1027977)

**Fedlberg, S.W.,** Improvements on computer simulation of electrochemical phenomena involving hydrodynamics: the rotating disk and the dropping mercury electrode, 6:33611
**Fee, D.C.,** Cesium thermomigration and reaction in nuclear fuels, 6:33313
Fuel-cladding chemical interaction in uranium-plutonium oxide fast reactor fuel pins, 6:33314
**Feeher, C.E.,** *See* Pew, R.W., 6:33333
**Feeley, J.J.,** Janus displays for improved reactor plant operation and control, 6:33331 (CONF-810606—71)
*See* Griffith, J.M., 6:33332
**Fei, Q.,** *See* Wang, X., 6:32962
**Feinendegen, L.E.,** *See* Iyengar, G.V., 6:33845, 6:33880
**Feldman, E.E.,** *See* Chang, L.K., 6:33301
**Feng, T.,** *See* Ghosh, A.K., 6:33107
**Fenimore, E.E.,** Spectral evolution of the 5 March 1979 $\gamma$ burst, 6:33937
**Fenster, S.,** *See* Colton, E., 6:33667
**Fenyves, E.J.,** *See* Cawley, C.N., 6:33823
**Ferger, T.M.,** *See* Simpkin, A.J., 6:32812
**Fergus, R.W.,** Hand and shoe monitor using air ionization probes, 6:33693
**Ferguson, E.,** *See* Cunniff, R.A., 6:33233
**Fernandez, E.,** *See* Derrick, M., 6:33973
**Ferrante, J.J.,** General Electric's large superconducting magnet design and development for fusion applications, 6:34086 (CONF-801011—(Vol.1), pp 269-282)
**Ferrell, P.C.,** Internal fuel motion as an inherent shutdown mechanism for LMFBR accidents: PINEX-3, PINEX-2, and HUT 5-2A experiments, 6:33355 (HEDL-SA—2264-FP)
**Field, R.E.,** *See* Graumann, D.W., 6:34107
**Filby, R.H.,** Development of novel radiochromatographic techniques for investigation of trace element behavior in coal liquefaction, 6:33825 (CONF-800433—, pp 571-586)
**File, J.,** *See* Jassby, D.L., 6:34147
**Fillo, J.A.,** *See* Horn, F.L., 6:33498
**Finch, C.B.,** *See* Tennery, V.J., 6:33546
**Findlay, R.H.,** *See* Bobbie, R.J., 6:33917
**Finger, M.,** *See* Helm, F.H. Jr., 6:33714
**Fink, R.W.,** *See* Braga, R.A., 6:34027
**Finkelstein, J.,** *See* Chew, G.F., 6:33982
**Finklea, E.E.,** Advanced logging techniques, 6:32961 (EPRI-WS—79-182, pp 3.11.1-3.11.23)
**Fischer, S.R.,** *See* Cheng, T.C., 6:33342
**Fish, M.J.,** Comparative economics of solar thermal central receivers, 6:33147 (SAND—81-8236)
**Fish, R.L.,** *See* Huang, F.F., 6:33511
**Fisher, D.R.,** Microdosimetry of lymphocytes irradiated by alpha particles, 6:33890 (PNL-SA—9315)
**Fisher, H.,** *See* Murphy, H., 6:33229
**Fishman, C.,** *See* Ghosh, A.K., 6:33107
**Fishman, H.,** *See* Yamazaki, K., 6:34069
**Fisk, H.E.,** Room temperature harmonic analysis of superconducting energy saver quadrupoles, 6:33674
**Fitch, W.N.,** *See* Cwik, M.J., 6:32888
**Fitzpatrick, C.M.,** *See* Schwenterly, S.W., 6:33633
**Fleming, R.F.,** *See* Lindstrom, R.M., 6:33773
**Flick, W.J.,** *See* Hayward, J.C., 6:32870
**Fliermans, C.B.,** *See* Orrison, L.H., 6:33876
**Flood, P.G.,** *See* Mallett, C.W., 6:32914
**Flora, R.H.,** *See* Koepke, K., 6:33676
**Flynn, E.R.,** $^{136}$sup(,)$^{138}$Ba(t,p) and the systematics of neutron pairing vibrations at N = 82, 6:34021
*See* Burke, D.G., 6:34022
*See* Girshick, F., 6:34026
**Flynn, T.,** Paradise Valley study area, 6:33216 (DOE/NV/10039—3, pp 83-159)
*See* Trexler, D.T., 6:33207
**Foley, G.F.,** Bottom ash handling from the 50's to the 90's, 6:32874 (EPRI-WS—79-236, pp 17.1-17.20)
**Folkmann, F.,** *See* Christensen, P.R., 6:34016
**Foote, F.B.,** *See* Reber, E.E., 6:33062
**Ford, A.L.,** *See* Reading, J.F., 6:33954
**Ford, J.L.C. Jr.,** *See* Dennis, L.C., 6:34003
**Foster, C.C.,** *See* Horen, D.J., 6:34020
**Fowler, M.,** *See* Nitschke, J.M., 6:34031
**Fox, G.C.,** *See* Kennett, R.G., 6:33972
**Fox, R.L.,** Project DEEP STEAM: fourth meeting of the technical advisory panel, Albuquerque, NM, November 1980, 6:32971 (SAND—81-0043)
**Francis, A.J.,** Microbial transformation of low-level radioactive waste, 6:33795 (BNL—29762)
**Frank, A.J.,** Photoelectrochemical solar cells: stabilization of small-band-gap semiconductor in aqueous solution by surface-attached organic conducting polymer, 6:33120 (SERI/TP—233-1388)
**Frank, H.G.,** Workshop proceedings: world oil and natural gas supplies, 6:32982 (EPRI-WS—79-182)
**Frankel, S.,** Very-high-energy nuclear physics. Progress report, July 1, 1980-June 30, 1981, 6:33968 (DOE/ER/04660—1)
**Franks, W.A.,** *See* Jain, M., 6:33018
**Fraser, H.L.,** Threshold voltage for damage in Si under electron bombardment, 6:33568
**Freeman, T.L.,** Optimization of solar heating and cooling systems, 6:33184 (NP—1903997)
**Freiesleben, H.,** *See* Christensen, P.R., 6:34016
**Freiser, B.S.,** *See* Burnier, R.C., 6:33960
**Fresco, A.,** *See* Brown, D.P., 6:33684
**Friedberg, E.C.,** *See* Reynolds, R.J., 6:33901
**Friedman, N.,** *See* Andersson, B., 6:33172
**Frier, W.A.,** *See* Swisher, J.H., 6:33373
**Fritz, J.S.,** *See* Gjerde, D.T., 6:33587
**Fry, D.J.,** *See* Adams, E.E., 6:33155
**Fry, R.J.M.,** Experimental radiation carcinogenesis: what have we learned, 6:33895
**Fryer, B.C.,** *See* Ribe, F.L., 6:34125
**Fugelso, L.E.,** *See* Bolivar, S.L., 6:33014
**Fukuoka, N.,** *See* Cleland, J.W., 6:34047
**Fukuya, K.,** *See* Ishino, S., 6:34128
**Fuller, F.H.,** PV1 model verification and validation, 6:33132 (MIT-EL—81-004)
*See* Lilien, G.L., 6:33098
**Fuller, W.,** *See* Sullivan, P.W., 6:33173
**Fulmer, C.B.,** Elastic and inelastic scattering of 88 MeV $^{6}$Li ions, 6:34013
**Furlong, M.,** *See* Nutt-Powell, T.E., 6:33100
**Furr, A.K.,** *See* Skelly, J.M., 6:33907
**Fusban, H.U.,** *See* Schmitt, B.F., 6:33786
**Fussell, J.B.,** Phased-mission system reliability analysis. Volume 2: computer code. Final report, 6:33350 (EPRI-NP—1945(Vol.2))

## G

**Gaarde, C.,** *See* Horen, D.J., 6:34020
**Gaffney, C.,** *See* Turco, M., 6:32927
**Gahn, R.F.,** *See* Reid, M.A., 6:33441
**Gaillard, M.K.,** Unification of elementary forces, 6:33981
**Gaillard, M.L.,** *See* Pegg, D.J., 6:33955
**Galanis, N.,** Simulation of a wind-powered water heater, 6:33251
**Galbraith, D.M.,** *See* Auble, R.L., 6:34010
**Gallagher, C.A.,** *See* Maddigan, R.J., 6:33427
**Ganesan, R.,** Study of heavy elements (Cd, Hg and Se) in the aquatic environment around Bombay by radiochemical neutron activation analysis, 6:33814 (CONF-800433—, pp 169-174)
**Gant, R.E.,** Potential opportunities for revitalization of the Rochester, New York steam district heating system, 6:33479 (ORNL/TM—7757)
**Ganzerli Valentini, M.T.,** Neutron activation analysis in the survey of river water quality and trace element distribution, 6:33812 (CONF-800433—, pp 106-118)
**Garcilazo, H.,** Corrections to the closure approximation for the pion-nucleon t-matrix inside the nucleus, 6:34004
**Gardner, W.L.,** *See* Whealton, J.H., 6:34181
**Garner, F.A.,** *See* Bates, J.F., 6:33514
*See* Brager, H.R., 6:33515, 6:33516
**Garrett, C.M. Jr.,** *See* Morton, R.A., 6:32991
**Gary, J.W.,** *See* Smits, R.G., 6:33637
**Gaskins, D.W. Jr.,** *See* Blankenship, J., 6:33406
**Gates, S.,** *See* Curtis, R., 6:33455
**Gebert, E.,** *See* Richards, R.R., 6:33596
**Gee, C.S.,** *See* Suidan, M.T., 6:32867
**Gee, G.W.,** Unsaturated moisture and radionuclide transport: laboratory analysis and modeling, 6:33804 (PNL—3616)
**Gelles, D.S.,** Microstructural examination of several commercial ferritic alloys irradiated to high fluence, 6:33512 (HEDL-SA—2338-FP)
**Genova, N.,** *See* Ganzerli Valentini, M.T., 6:33812
*See* Maggi, L., 6:33818
**Gentry, R.A.,** Measurement of gas density and temperature distributions in strongly rotating $UF_6$ using laser-induced fluorescence, 6:33619 (LA-UR—81-2530)
*See* Cloutman, L.D., 6:33016
**Geoffroy, G.L.,** Mechanistic studies of carbon monoxide reduction. Progress report, August 1, 1980-August 1, 1981, 6:33080 (DOE/ER/10345—2)
**Gerber, S.B.,** *See* Loomis, B.A., 6:33539
**German, M.D.,** *See* Kumar, V., 6:33510
**Germani, M.S.,** *See* Zoller, W.H., 6:33728

**Gerrard, C.M.,** Role of geomechanics research in Australian coal mines, 6:32915
**Gerstein, B.C.,** *See* Murphy, P.D., 6:33582
**Gerstl, S.A.W.,** Reduction of photosynthetically active radiation under extreme stratospheric aerosol loads, 6:33745 (LA—8938-MS)
**Ghaffari, H.T.,** Comparative thermal performance of direct gain, Trombe, and sunspace walls, 6:33158 (BNL—29970)
**Ghiorso, A.,** *See* Nitschke, J.M., 6:34031
**Ghosh, A.K.,** Thin-film polycrystalline-silicon solar cells. Quarterly report No. 1, January 1-March 31, 1979, 6:33107 (DOE/ET/23047—T2)
**Ghosh, S.,** Bioconversion energy systems: new developments and opportunities, 6:33085
Kinetics of acid-phase fermentation in anaerobic digestion, 6:33086
**Ghusn, G.,** Statewide geothermal resource assessment, 6:33208 (DOE/NV/10039—3, pp 191-196)
**Ghusn, G. Jr.,** *See* Trexler, D.T., 6:33207
**Gibbs, W.R.,** *See* Garcilazo, H., 6:34004
**Gibson, G.H.,** *See* Smits, R.G., 6:33637
**Gilbert, E.R.,** *See* Lovell, A.J., 6:33535
**Gilbert, E.S.,** Problems in evaluating health effects of occupational and environmental exposures, 6:33891 (PNL-SA—9632)
**Gildea, P.D.,** *See* Mintz, J.M., 6:34100
**Gill, G.E.,** *See* Skehan, J.W., 6:32899
**Gill, J.S.,** *See* Adler, H.I., 6:33898
**Gillespie, L.K.,** Drill geometries for miniature holes, 6:33628 (BDX—613-2623)
**Gillespie, T.J.,** *See* Creed, K.E., 6:33069
**Gilliam, T.M.,** *See* Canon, R.M., 6:33469
**Gilligan, J.G.,** Conceptual design of a compact field reversed mirror reactor: SAFFIRE, 6:34149 (CONF-801011—(Vol.3), pp 840-853)
**Ginsberg, M.J.,** Reaction rates from pressure-gauge measurements in reacting explosives, 6:33710 (LA-UR—81-2482)
**Girman, J.R.,** *See* Offermann, F.J., 6:33458
**Girshick, F.,** $^{176}Lu(t,p)^{178}Lu$ reaction. The influence of shell gaps and blocking on L = 0 strenght, 6:34026
**Gjerde, D.T.,** Chromatographic separation of metal ions on macroreticular anion-exchange resins of a low capacity, 6:33587
Ion chromatography with low-capacity resins and low-conductivity eluents, 6:33571
**Glandon, S.R.,** *See* Berger, C.D., 6:33361
**Glas, R.,** *See* Wahlig, M., 6:33174
**Gleick, P.H.,** Assessing environmental risks of energy, 6:33837
**Glicksman, J.,** Thermal analysis of the TFTR surface pumping system, 6:34162 (CONF-801011—(Vol.3), pp 1017-1023)
**Gobran, B.D.,** Effects of confining pressure, pore pressure and temperature on absolute permeability. SUPRI TR-27, 6:32986 (DOE/ET/12056—27)
**Goetz, F.,** *See* Egger, J.P., 6:34014
**Goff, F.E.,** Hot dry rock geothermal prospects, 1981, 6:33219 (LA-UR—81-1807)
**Goh, T.N.,** Comparative study of wind characteristics from different time periods, 6:33244
**Gohar, Y.,** Study of DD versus DT fusion fuel cycles for different fusion-fission hybrid energy systems, 6:34119 (CONF-801011—(Vol.2), pp 1497-1504)
*See* Morgan, G.D., 6:34143
**Gold, R.E.,** *See* Scott, J.L., 6:34126
**Goldberg, P.M.,** *See* Haebig, J.E., 6:32947
**Goldbrunner, P.R.,** *See* Piulle, W., 6:32871
**Goldsmith, M.,** Comparisons of turbulent-flow calculations with experiment, 6:33653 (WAPD-TM—1473)
**Goldstein, G.R.,** *See* Lo, C.Y., 6:33988
**Goldsworthy, D.L.,** First-principle dynamic modeling of an MHD-steam coupled power plant, 6:33268
**Golino, M.D.,** *See* Boyd, J.B., 6:33861
**Golshani, A.,** Ocean thermal energy conversion gas-desorption studies. Volume 2. Deaeration in a packed column and a barometric intake system, 6:33156 (ORNL/TM—7438-Vol.2)
**Gomez del Campo, J.,** Description and use of the Monte Carlo code LILITA, 6:34019 (ORNL/TM—7295)
*See* Dennis, L.C., 6:34003
**Gomiscek, S.,** Kinetics of the reaction between $NH_2OH$ and $SO_2$ in aqueous solutions, 6:33751 (LBL—11986, pp 5.13-5.14)
**Gonor, J.J.,** *See* Beasley, T.M., 6:33888
**Gonsior, B.,** *See* Wilde, H.R., 6:33734
**Gonzalez, F.,** *See* Schmidt, T.R., 6:33338
**Goodbread, D.T.,** *See* Bavinger, B.A., 6:32967
**Goode, C.A.,** Support selection for the multi-lift mining method, 6:32903 (CONF-810714—3)
**Goodin, D.T.,** *See* Ehmann, W.D., 6:33879
**Goodman, C.D.,** *See* Fulmer, C.B., 6:34013
*See* Horen, D.J., 6:34020
**Goodman, D.M.,** Quadrantal symmetry calculations for nonsymmetric half-plane filters, 6:34197 (UCRL—85156-Rev.1)
**Goodman, D.S.,** *See* Borek, C., 6:33849
**Goodrich, L.F.,** Superconductivity in Th-Nb composites, 6:33520 (IS-T—926)
**Goodrich, R.,** *See* Cheng, E.T., 6:33064
**Gordon, B.M.,** Use of a synchrotron radiation x-ray microprobe for elemental analysis at the national synchrotron light source, 6:33790 (CONF-800433—, pp 268-274)
**Gordon, G.E.,** Use of neutron-capture prompt gamma-ray activation analysis in environmental and energy research, 6:33806 (CONF-800433—, pp 181-194)
*See* Anderson, D.L., 6:33777
*See* Rheingrover, S.W., 6:33727
**Gordon, J.D.,** Environmental and safety implications of alternate fuel fusion cycles, 6:34102 (CONF-801011—(Vol.2), pp 1224-1226)
**Gore, B.F.,** Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)
**Gossler, A.A.,** *See* Chan, S.H., 6:33345
**Gottschalk, B.,** Coordinate measurement by current division: a simple system for multichannel detectors, 6:33691 (SLAC-TN—81-6)
**Goulding, C.A.,** *See* Horen, D.J., 6:34020
**Goyer, R.,** Health effects: indoor air quality research strategy plan, 6:33885 (CONF-801259—, pp 97-136)
**Gozani, T.,** *See* Tassicker, O.J., 6:32932
**Granger, C.W.J.,** *See* Ramanathan, R., 6:33421
**Grass, F.,** Activation analysis with short lived nuclides in environmental research, 6:33735 (CONF-800433—, pp 337-352)
**Graumann, D.,** *See* Barry, K., 6:34167
**Graumann, D.W.,** STARFIRE remote maintenance and reactor facility concept, 6:34107 (CONF-801011—(Vol.2), pp 1319-1335)
**Gray, L.J.,** *See* Kaplan, T., 6:33506
**Gray, L.W.,** Recovery of americium-241 from aged plutonium metal, 6:33572 (DP—1577)
**Green, B.,** *See* Ruane, M., 6:33271
**Green, L.,** Review of integral fusion blanket neutronic experiments, 6:34091 (CONF-801011—(Vol.1), pp 395-404)
*See* Lee, A.Y., 6:34141
**Green, M.A.,** *See* Smits, R.G., 6:33637
**Green, M.M.,** *See* Boyd, J.B., 6:33861
**Greene, J.M.,** *See* Chu, M.S., 6:34059
**Greene, S.J.,** *See* Morris, C.L., 6:34005
**Greenfield, M.B.,** *See* Horen, D.J., 6:34020
**Greenlee, D.W.,** *See* Calloway, N.E., 6:33353
**Greenspan, E.,** CAT-D-T tokamaks, 6:34154 (CONF-801011—(Vol.3), pp 946-954)
**Gregory, A.R.,** Assessment of in-place solution methane in tertiary sandstones: Texas Gulf Coast, 6:32990 (CONF-811026—5)
**Gregory, W.S.,** Development of two-phase flow and material-transport models for large-diameter drilling systems: program overview and preliminary results, 6:33636 (LA—8894-MS)
**Grenon, M.,** World oil and gas reserves, 6:33413 (EPRI-WS—79-182, pp 3.9.1-3.9.15)
**Gretillat, P.,** *See* Egger, J.P., 6:34014
**Grieger, G.,** *See* Johnson, J.L., 6:34182
**Grier, B.H.,** *See* Sato, M., 6:34043
**Griffis, L.C.,** Method of determining glass in rat lung after exposure to a glass fiber aerosol, 6:33914
**Griffith, J.M.,** Optimal calibration of nuclear instrumentation, 6:33332 (CONF-810606—72)
**Grimes, J.G.,** *See* Butz, T.R., 6:33006
**Grimsrud, D.,** Energy performance of buildings, 6:33451 (LBL—11985, pp 4.2-4.6)
**Grimsrud, D.T.,** *See* Blomsterberg, A.K., 6:33457
**Grisham, D.L.,** Why high-capacity manipulators and lead glass windows, 6:33671 (LA-UR—81-2571)
**Gronsky, R.,** Metallurgy and ceramics, 6:33699 (LBL—12000, pp 3-138)
**Gross, E.E.,** *See* Fulmer, C.B., 6:34013
**Grossbeck, M.L.,** *See* Scott, J.L., 6:34126
**Grossman, G.,** *See* Perez-Blanco, H., 6:33471
**Grossman, R.F.,** *See* Smith, D.D., 6:33802
**Grove, D.J.,** Status of TFTR, 6:34155 (CONF-801011—(Vol.3), pp 957-960)
**Gruber, J.,** *See* Sullivan, P.W., 6:33173
**Gruhl, J.,** *See* Ruane, M., 6:33271
**Gschneidner, K.A. Jr.,** *See* Takeshita, T., 6:33559

**Guerra, C.R.,** *See* Endicott, R.D., 6:34105
**Guinn, V.P.,** *See* de Lancey, K., 6:33817
**Gumnick, J.L.,** *See* Bavinger, B.A., 6:32967
**Gundel, L.,** Determination of black carbon by thermal analysis, 6:33755 (LBL—11986, pp 5.26-5.30)
Relation between concentrations of polynuclear aromatic hydrocarbons and black carbon, 6:33757 (LBL—11986, pp 5.32-5.34)
**Gunn, R.B.,** *See* Streuli, R.A., 6:33855
**Gunter, G.,** *See* Venkataramiah, A., 6:33909
**Gupta, S.K.,** Description and applications of the FE3DGW and CFEST three-dimensional finite-element models, 6:33053 (LBL—11566, pp 77-85)
**Guymon, L.G.,** *See* Kovar, F.R., 6:33716
**Guzek, J.,** *See* Parks, C.F., 6:32939
**Gyulassy, M.,** Non-linear vacuum polarization in strong fields, 6:33974 (LBL—12972)

## H

**Haas, J.E.,** *See* Roelke, R.J., 6:33486
**Haas, W.J. Jr.,** Automated on-line determination of PPB levels of sodium and potassium in low-Btu coal gas and fluidized bed combustor exhaust by atomic emission spectrometry, 6:32861 (IS-M—330)
**Hackley, D.S.,** Engineering and producing the General Dynamics/IGC magnet for the Large Coil Program, 6:34087 (CONF-801011—(Vol.1), pp 283-292)
**Hadley, G.R.,** Evaporative water loss from welded tuff, 6:33021
**Haebig, J.E.,** Effects of components of synfuels on soot formation. Quarterly technical progress report Number 3, April 1-June 30, 1981, 6:32947 (DOE/PC/30307—3)
**Hagaman, E.W.,** Statistical coal structure anaiysis cross polarization/magic angle spinning (CP/MAS)-$^{13}$C-NMR spectroscopy: quantitative evaluation of aromaticity parameters, 6:32857 (CONF-810914—5)
**Haggmark, L.G.,** *See* Biersack, J.P., 6:34041
**Haglund, R.A.,** Dish Stirling solar receiver program. Final report, 6:33145 (NASA-CR—163889)
**Hahn, O.J.,** Economics of synfuel and gasification systems, 6:32959
**Hahs, T.S.,** Antireflecting film development. Final report, 6:33563 (UCRL—15373)
**Haimes, Y.Y.,** Scientific, technological and institutional aspects of water resource policy, 6:33811
**Hakki, A.,** Generation planning system: methodology and case study. Final report, 6:33423 (EPRI-EA—1807)
**Hakonson, T.E.,** *See* White, G.C., 6:33903
**Halama, H.J.,** Cryopumping of hydrogen and helium, 6:33630 (BNL—30012)
**Haldar, B.C.,** *See* Ganesan, R., 6:33814
*See* Shah, P.K., 6:33736
**Hale, M.D.,** *See* Lembke, L.L., 6:33763
**Hall, E.J.,** How and why of in vitro oncogenic transformation, 6:33894
**Hall, T.E.,** *See* Collins, H.D., 6:33330
**Hallquist, J.O.,** *See* Nutt, G.L., 6:33702
**Hals, F.A.,** Conceptual design study of potential early commercial MHD powerplant. Final report of Task 2 results, 6:33435 (DOE/NASA/0051—2)
**Hamed, A.,** *See* Beacher, B., 6:32943
**Hamilton, N.I.,** Solar radiation flux distributions in cavity receivers, 6:33142 (DOE/ET/21015—9)
**Hammaren, E.,** *See* Burke, D.G., 6:34022
**Hampel, V.E.,** Fact retrieval for the 1980s, 6:34202 (UCRL—85749)
**Hanck, J.A.,** Research to develop guidelines for cathodic protection of concentric neutral cables. Interim report, 6:33280 (EPRI-EL—1970(Vol.1))
Research to develop guidelines for cathodic protection of concentric neutral cables. Interim report, 6:33281 (EPRI-EL—1970(Vol.2))
**Hanna, S.R.,** Handbook on atmospheric diffusion models, 6:33724 (ATDL—81/5)
**Hansborough, L.D.,** Radio-frequency quadrupole linac in a heavy-ion fusion driver system, 6:34113 (CONF-801011—(Vol.2), pp 1417-1419)
**Hansen, A.,** Model for the progressive combustion analysis of carbonaceous aerosol particles, 6:33756 (LBL—11986, pp 5.30-5.32)
**Hansen, C.J.,** *See* Cox, J.P., 6:33943
**Hansen, O.,** *See* Christensen, P.R., 6:34016
**Harari, H.,** *See* Cahn, R.N., 6:33979
**Hardekopf, R.A.,** *See* Ohlsen, G.G., 6:33998
**Hardin, G.,** Bodcau in situ combustion project. Fourth annual report, September 1, 1979-February 28, 1981, 6:32969 (DOE/ET/12057—8)
**Harleman, D.R.F.,** *See* Adams, E.E., 6:33155
**Harlow, F.H.,** Propagation of a liquid-liquid explosion, 6:33360 (LA—8971-MS)
**Haroldsen, R.O.,** Micro-hydropower in the United States, 6:33089 (EGG-M—02781)
**Harrar, J.E.,** Precious metal analysis by controlled potential coulometry, 6:33583
*See* Richardson, J.H., 6:33614
**Harris, J.A.,** *See* Hosier, J.C., 6:32840
**Harrold, R.T.,** Acoustic waveguide technique for sensing incipient faults in underground power-transmission cables: including acousto-optic techniques. Final report, 6:33277 (DOE/ET/29335—T1)
**Hart, C.M.,** *See* Fox, R.L., 6:32971
**Harte, J.,** Acid precipitation damage to aquatic ecosystems, 6:33822 (LBL—11986, pp 5.47-5.50)
Assessment of optimum aquatic microcosm design for pollution impact studies, 6:33821 (EPRI-EA—1989)
Assessment of optimum microcosm design for pollution impact studies, 6:33911 (LBL—11986, pp 5.43-5.47)
**Harter, M.L.,** *See* Smart, J.E., 6:33874
**Hartman, J.S.,** Spectral response measurements for solar cells, 6:33116 (PNL-SA—9751)
**Hartwig, E.,** *See* Faltens, A., 6:34110
*See* Venkataramiah, A., 6:33909
**Harty, R.,** *See* Fisher, D.R., 6:33890
**Harvey, C.J.,** *See* Morris, C.L., 6:34005
**Harvey, J.R.,** *See* Kovar, F.R., 6:33716
**Haselton, H.H.,** *See* Whealton, J.H., 6:34181
**Hashemi, M.,** *See* Clark, J., 6:33255, 6:33256
**Hashimoto, K.,** *See* Terai, M., 6:33878
**Hasibar, R.M.,** Application of high-speed grounding switches for single-pole reclosing on 500 kV power systems, 6:33283
**Hastlett, J.,** Simple model for the probability distribution of wind power with applications to large scale electricity generation, 6:33246
**Hatfield, M.A.,** Zoning lands unsuitable for surface coal mining: an economic review, 6:32955 (ANL/LRP-TM—20, pp 55-62)
**Hauer, A.,** Survey of atomic physics issues in experimental inertial confinement research, 6:34184 (SAND—81-1864C)
**Hauer, J.F.,** Measurement and modeling of Pacific ac Intertie response to random load switching, 6:33288
**Hausler, D.W.,** *See* Taylor, L.T., 6:32843
**Hawke, R.S.,** *See* Brooks, A.L., 6:33641
**Hays, G.N.,** *See* Hoffman, J.M., 6:34183
**Hayward, J.C.,** Coal waste artificial reef program, Phase 3. Volume 3. Engineering-economic evaluation of fixed coal waste block production and disposal. Final report, 6:32870 (EPRI-CS—2009(Vol.3))
**Hazen, T.C.,** Agglutinating antibody to Aeromonas hydrophila in wild largemouth bass, 6:33877
**Headrick, L.A.,** Working with asbestos, 6:33919 (K/RA—106)
**Heald, S.M.,** Applications of bent cylindrical mirrors to x-ray beamlines, 6:33687 (BNL—29940)
**Heatherly, L.,** *See* Clausing, R.E., 6:34056
**Hebblewhite, B.K.,** *See* Warburton, P.M., 6:32905
**Heck, F.M.,** *See* Crotzer, M.E., 6:34099
*See* Lipner, M.H., 6:34081
**Hecker, S.S.,** Temperature-induced transformation in a Pu-2at.% Al alloy, 6:33524 (LA-UR—81-2455)
*See* Zukas, E.G., 6:33525
**Heft, R.E.,** *See* Ondov, J.M., 6:33762
**Hegg, D.A.,** Reactions of nitrogen oxides, ozone and sulfur in power plant plumes, 6:33744 (EPRI-EA—270)
**Heinrich, J.P.,** *See* Ferrante, J.J., 6:34086
**Heitz, A.,** *See* Wahlig, M., 6:33174
**Helgerson, R.N.,** *See* Butz, T.R., 6:33006
**Helm, F.H. Jr.,** Detonation-product behavior at large expansion: the underwater detonation of nitromethane, 6:33714 (UCRL—52903)
**Helms, J.R.,** *See* Shain, W.A., 6:33886
**Helton, F.J.,** *See* Bernard, L.C., 6:34060
*See* Chu, M.S., 6:34059
*See* Wang, T.S., 6:34058
**Henager, C.H. Jr.,** Stress dependence of creep in Ni bombarded with 17-MeV deuterons, 6:33532 (PNL-SA—9728)
*See* Simonen, E.P., 6:33530
**Henderson, J.M.,** Fuel pin behavior under slow overpower transient conditions; HEDL W-2 SLSF experiment results, 6:33357 (HEDL-SA—2284-FP)
Sodium boiling and mixed oxide fuel thermal behavior in FBR

undercooling transients; W-1 SLSF experiment results, 6:33354 (HEDL-SA—2263-FP)
**Henderson, R.F.,** Low-Btu-gasifier emissions toxicology. Status report, December 1980, 6:32960 (LMF—85)
**Henderson, T.R.,** *See* Griffis, L.C., 6:33914
**Henicksman, A.,** *See* Peterson, E.J., 6:32995
**Henning, S.J.,** Analysis of post-restoration agricultural management at the Iowa coal project demonstration mine, 6:32884 (ANL/LRP-TM—20, pp 93-102)
**Hensley, D.C.,** *See* Fulmer, C.B., 6:34013
**Hepworth, J.K.,** Measurement of strain across a transition joint interface using Moire fringes, 6:33325 (R/M/N—1068)
**Herhal, A.J.,** *See* Hill, F.E., 6:32906
**Hermelee, A.,** *See* D'Acierno, J., 6:33398
**Hersh, S.,** *See* Piper, B.F., 6:32989
**Hester, R.D.,** *See* McCormick, C.L., 6:32968
**Heusinkveld, M.E.,** Calculations on seismic coupling of underground explosions in salt, 6:33720 (UCRL—53103)
**Hicks, H.G.,** Results of calculations of external gamma-radiation exposure rates from fallout and the related radionuclide compositions. Operation Ranger, 1951, 6:33805 (UCRL—53152-Pt.1)
**Hill, C.T.,** Large distance effects in CP violation and the $K^0$-anti $K^0$ mass matrix, 6:33984
**Hill, D.,** *See* Pierce, B., 6:33464
**Hill, F.E.,** Analysis of the labor productivity decline in the U.S. bituminous coal mining industry. Final technical report , 6:32906 (DOE/ET/10033—T2)
**Hill, J.,** *See* Bird, N., 6:32980
**Hill, M.W.,** Trace element analysis of wild rodent tissues using the PIXE method, 6:33775 (CONF-800433—, pp 549-559)
**Hilliard, P.T.,** *See* Lane, G.J., 6:33660
**Hinman, C.A.,** Transient redistribution of intragranular fission gas in irradiated mixed oxide, 6:33356 (HEDL-SA—2272)
**Hintz, N.M.,** Nuclear structure study at intermediate energies. Annual progress report, November 1980-July 1981, 6:33992 (DOE/ER/04215—5)
**Hinze, W.J.,** *See* Tinnel, E.P., 6:32999
**Hirsch, E.G.,** Design and operation of compact bottom ash basins for 500 MW of generating capacity, 6:32875 (EPRI-WS—79-236, pp 18.1-18.16)
**Hirsch, J.,** *See* Curtis, R., 6:33455
**Hirschfeld, T.,** Hy-phen-ated methods, 6:33585
**Hirst, E.,** *See* Talwar, R., 6:33397
**Hobbs, B.B.,** *See* Raines, W.L., 6:33799
**Hobbs, M.,** *See* Clark, J., 6:33255, 6:33256
**Hobbs, P.V.,** *See* Hegg, D.A., 6:33744
**Hochmuth, J.,** *See* Stonehart, P., 6:33440
**Hodges, L.,** *See* McClelland, J.F., 6:33169
**Hodson, S.W.,** Nonlinear calculations for BL Her stars, 6:33942
*See* Cox, J.P., 6:33943
*See* Starrfield, S.G., 6:33949
**Hoffman, A.L.,** *See* Willenberg, H.J., 6:34152
**Hoffman, A.R.,** Bias-humidity testing of solar-cell modules, 6:33108 (DOE/JPL—1012-78/11)
**Hoffman, H.W.,** Meteorological Effects of Thermal Energy Releases (METER) program. Annual progress report, October 1979-September 1980, 6:33769 (ORNL/TM—7744)
**Hoffman, J.M.,** Phoenix II energy extraction and angular multiplexing experiments, 6:34183 (SAND—81-1472)
**Hoffmann, M.R.,** Kinetics of the removal of iron pyrite from coal by microbial catalysis, 6:33871
**Hofmann, R.,** Development of an explicit finite-difference fluid flow model, 6:33922 (LBL—11566, pp 111-114)
**Hofstetter, K.J.,** On-line monitoring of Plutonium in mixed Uranium-Plutonium solutions, 6:33800 (CONF-800433—, pp 705-717)
**Hogan, W.W.,** Dimensions of energy demand, 6:33402
**Holcomb, B.D.,** *See* Maddigan, R.J., 6:33427
**Holden, N.E.,** Neutron capture cross section standards for BNL 325, Fourth Edition, 6:34039 (BNL-NCS—51388)
**Holdren, J.P.,** Fusion-fission hybrids: environmental aspects and their role in hybrid rationale, 6:34188
*See* Gleick, P.H., 6:33837
**Holland, J.R.,** *See* DelVecchio, R.M., 6:33063
**Hollister, C.D.,** *See* Bowen, V.T., 6:33034
**Hollon, J.K.,** Solar energy for California's residential sector: progress, problems, and prospects, 6:33104
**Hollowell, C.D.,** Indoor air quality, 6:33758 (LBL—12887)
*See* Offermann, F.J., 6:33458
**Holman, B.L.,** *See* Osborne, L.S., 6:33689
**Holmes, J.J.,** *See* Scott, J.L., 6:34126
**Holmes, J.T.,** Heliostat operation at the Central Receiver Test Facility (1978-1980), 6:33146 (SAND—81-0275-Rev.)
**Holt, W.H.,** *See* Singh, J.J., 6:33789
**Holtkamp, D.B.,** *See* Morris, C.L., 6:34005
**Holub, E.,** *See* Drake, D.M., 6:34007
**Hombach, H.P.,** *See* Collins, C.J., 6:33606
**Homburg, E.,** Pneumatic conveying of fly ash in the pulse phase, 6:32873 (EPRI-WS—79-236, pp 16.1-16.10)
**Homsy, R.V.,** *See* Cooper, J.F., 6:33492
**Hoover, D.Q. Jr.,** Cell-module & fuel-conditioner development. 6th quarterly report, January-March 1981, 6:33439 (DOE/NASA/0161—7)
**Hopke, P.K.,** *See* Alpert, D.J., 6:33726
*See* Roscoe, B.A., 6:33783
*See* Williams, R.E., 6:33787
**Hopkins, C.C.,** *See* Tenney, F.H., 6:34075, 6:34101, 6:34138
**Hopkins, G.,** *See* Sevier, D.L., 6:34172
**Hopper, J.L.,** *See* Smith, D.D., 6:33802
**Horen, D.J.,** Energy systematics of the giant Gamow-Teller resonance and a charge-exchange dipole spin-flip resonance, 6:34020
**Horn, F.L.,** Thermal conductivity measurements of insulators for fusion blankets, 6:33498 (BNL—29779)
**Horrigan, J.W.,** Oil ash handling case history, 6:32872 (EPRI-WS—79-236, pp 15.1-15.36)
**Horrigmoe, G.,** *See* Bazant, Z.P., 6:33556
**Horvath, D.,** Test results of the Chrysler upgraded automotive gas-turbine engine: initial design, 6:33487 (DOE/NASA/51040—22)
**Hosler, J.C.,** Sulfidation resistance of high-temperature alloys tested in reducing and oxidizing atmospheres, 6:32840
**Hossian, T.I.M.,** *See* Ehmann, W.D., 6:33879
**Hoth, C.W,** Analysis of in-core coolant temperatures of FFTF instrumented fuels tests at full power, 6:33337 (HEDL-SA—2330-Rev.1)
**Hou, X.,** Investigation of high temperature corrosion of Ni-Cr alloy by the burning hydrocarbons, 6:33662
**Houk, R.S.,** Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
**Houmans, J.J.,** *See* Horrigan, J.W., 6:32872
**Houser, T.,** Fundamentals of nitric oxide formation in fossil-fuel combustion. Progress report, 29 September-28 December 1980, 6:32944 (DOE/ET/10593—T2)
**Housseiney, A.,** *See* Aframian, A., 6:33884
**Howard, B.D.,** Solar energy system performance evaluation: Aratex Services, Fresno, California, December 1979-November 1980, 6:33190 (SOLAR/2008—81/14)
**Howe, H.J. Jr.,** *See* Levine, J.D., 6:34106
**Howe, S.O.,** *See* Pierce, B., 6:33464
**Howell, R.H.,** Least squares method for analyzing broadened X-ray line shapes, 6:34050
**Hoyer, E.,** *See* Faltens, A., 6:34110
**Hrubesh, L.W.,** *See* Richardson, J.H., 6:33584
**Hseuh, H.C.,** *See* Halama, H.J., 6:33630
**Hsieh, T.C.,** *See* Liu, Y.Y., 6:33307
**Hsu, C.H.,** Effect of applied stress on the transformation behavior of Ni-Ti, 6:33518 (IS-M—338)
**Hsu, L.C.,** *See* Philipp, W.H., 6:33616
**Hsu, M.,** Posttest analysis of international standard problem 10 using RELAP4/MOD7, 6:33341 (CONF-810606—73)
**Huang, C.Y.,** *See* Clawson, C.W., 6:33957
**Huang, F.F.,** Notch tensile behavior of irradiated 20% cold-worked Type 316 stainless steel, 6:33511 (HEDL-SA—2317)
**Hudson, E.D.,** Helical axial injection concept for cyclotrons, 6:33670 (CONF-810944—1)
**Huenefeld, J.C.,** Study of non-Darcy natural convection from a vertical heated surface in a saturated porous medium, 6:33963 (PNL-SA—9712)
**Huff, G.A.,** *See* Hofstetter, K.J., 6:33800
**Huggins, J.M.,** *See* Jones, W.D., 6:33594
**Hulet, E. K.,** *See* Nitschke, J.M., 6:34031
**Hulet, E.K.,** Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:33624
Kinetic energy deficit in the symmetric fission of $^{259}$Md, 6:34030
Recent searches for superheavy elements in deep-inelastic reactions, 6:34029
**Hull, J.R.,** *See* McClelland, J.F., 6:33169
**Hulse, R.A.,** *See* Post, D.E., 6:34074
**Humenick, M.J.,** *See* Mattroc, C.F., 6:32853

**Hunter, C.W.,** *See* Cannon, N.S., 6:33358
**Huntington, J.,** *See* Enever, J., 6:32922
**Hupe, D.W.,** Monitoring the fixed FGD sludge landfill, Conesville, Ohio. Phase II, 6:32869 (EPRI-CS—1984)
**Hurlbut, F.C.,** Molecular-beam system for the study of transient combustion processes, 6:33626 (LBL—13178)
**Husain, J.,** *See* McFarland, R.H., 6:33791
**Hussein, M.S.,** *See* Carlson, B.V., 6:34025
**Hustrulid, W.A.,** *See* Pratt, H.R., 6:33924
**Hyman, L.,** *See* Derrick, M., 6:33973

## I

**Ichikawa, Y.,** *See* Buckman, R.W. Jr., 6:33372
**Ichimura, V.I.,** Hydrologic studies support, INTERCOMP code conversion. Annual report. Research report 80/15-44, 6:33023 (DOE/RL/10119—1)
**Igata, N.,** Surface radiation damage in molybdenum alloys irradiated, 6:34127 (CONF-801011—(Vol.2), pp 1673-1682)
**Iguchi, T.,** Neutron spectra and tritium production rate measurements in the one dimensional LiF slab geometry as a fusion reactor blanket benchmark experiment, 6:34090 (CONF-801011—(Vol.1), pp 387-394)
**Ikemoto, R.N.,** *See* Masand, A.C., 6:33292
**Iles, P.A.,** *See* Yoo, H.I., 6:33111
**Illige, J.D.,** *See* Yu, C.M., 6:33567
**Imel, G.R.,** *See* Jassby, D.L., 6:34053
**Impink, A.J. Jr.,** *See* Lipner, M.H., 6:34081
**Imura, H.,** *See* Suzuki, N., 6:33737
**Ingham, J.G.,** Heat transfer in a fuel pin shipping container, 6:33635 (HEDL-SA—2201-FP)
**Ingram, R.L.,** Peat deposits of Dismal Swamp pocosins: Camden, Currituck, Gates, Pasquotank, and Perquimans Counties, North Carolina, 6:32898 (DOE/ET/14693—T3)
**Inouye, H.,** Thorium doped iridium alloy for radioisotope heat sources, 6:33536
**Inouye, T.,** Direct image reconstruction with limited angle projection data for computerized tomography, 6:33865 (CONF-800433—, pp 54-59)
**Isaacs, H.S.,** Determination of surface inhomogeneities qfing a scanning probe impedance technique, 6:33610
**Isaacson, R.,** Advanced system experimental facility: solid waste to methane gas. Background and process description, 6:33079 (ANL/CNSV—22)
**Ishibai, K.,** *See* Watanabe, T., 6:33551
**Ishii, M.,** *See* Chen, W.L., 6:33366
**Ishino, S.,** In-situ observation of radiation damage by 400 keV heavy ions, 6:34128 (CONF-801011—(Vol.2), pp 1683-1689)
**Iso, Y.,** JT-60 project and its present status, 6:34156 (CONF-801011—(Vol.3), pp 964-969)
**Itoh, K.,** *See* Suenaga, M., 6:33502
**Iyengar, G.V.,** Influence of post mortem changes on the elemental composition of rat liver studied by atomic absorption spectrometry and neutron activation analysis, 6:33880 (CONF-800433—, pp 491-499)
Retention of metabolized trace elements in rat tissues: silver, cerium, caesium, manganese, scandium and tin, 6:33845 (CONF-800433—, pp 480-490)

## J

**Jackson, G.L.,** *See* Puhn, F.A., 6:34150
**Jackson, H.E.,** *See* McKeown, R.D., 6:34001
**Jackson, J.A.,** Magnetic resonance apparatus, 6:33707
**Jackson, T.,** *See* La Mar, G.N., 6:33593
**Jahnig, C.E.,** *See* Cain, W.C., 6:32895
**Jain, M.,** DISFUL manual, 6:33018 (DOE/SR/01069—1)
**Jain, M.L.,** Assessment of coal-using, combined-cycle, heat-engine options for residential/commercial total and integrated energy systems, 6:33252 (ANL/FE—81-55)
**Jansen, P.,** *See* Abdel-Khalik, S.I., 6:34103
**Jardin, S.C.,** Stabilizing windings for the tilting and shifting modes in an inductively formed spheromak, 6:34066 (PPPL—1814)
**Jarrett, A.R.,** *See* Brenizer, J.S. Jr., 6:33819
**Jarvinen, P.O.,** *See* Hamilton, N.I., 6:33142
**Jaspal, J.S.,** *See* Goode, C.A., 6:32903
**Jassby, D.L.,** Fusion energy calorimeter for the tokamak fusion test reactor, 6:34053 (CONF-801011—(Vol.3), pp 788-794)
Lithium blanket module tests on the TFTR, 6:34147 (CONF-801011—(Vol.3), pp 782-787)
**Jedruch, J.,** *See* Lee, A.Y., 6:34141
**Jenkins, C.E.,** Proposed draft standard ANS 11.18: recommendations to facilitate decontamination and decommissioning, 6:33638 (PNL-SA—9635)
**Jennings, S.,** *See* Clark, J., 6:33255, 6:33256
**Jenquin, U.P.,** *See* Gore, B.F., 6:33056
**Jensen, B.,** *See* Cheng, E.T., 6:33064
**Jensen, B.K.,** Utility market penetration assessment of fusion-fission hybrids, 6:34118 (CONF-801011—(Vol.2), pp 1475-1486)
*See* Endicott, R.D., 6:34105
**Jensen, B.L.,** Guide to Douglas Point, Charles County, Maryland, 6:33807 (DOE/SR/10018—5)
**Jensen, T.H.,** *See* Chu, M.S., 6:34059
**Jerabek, P.A.,** *See* Miller, G.E., 6:33778
**Jester, W.A.,** Evaluation of airborne radioactive Iodine and noble gas environmental monitors using short-lived research reactor-produced radionuclides, 6:33765 (CONF-800433—, pp 534-539)
*See* Brenizer, J.S. Jr., 6:33819
**Johanson, J.R.,** *See* Turco, M., 6:32927
**Johnson, A.B. Jr.,** Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Johnson, C.E.,** *See* Fee, D.C., 6:33313, 6:33314
**Johnson, D.C.,** *See* Richardson, J.H., 6:33584
**Johnson, D.R.,** *See* Fox, R.L., 6:32971
**Johnson, I.,** *See* Lee, S.H.D., 6:33269
*See* Shearer, J.A., 6:32954
**Johnson, J.L.,** Stellarator program, 6:34182 (PPPL—1832)
**Johnson, M.E.,** Bivariate distributions with given marginals and fixed measures of dependence, 6:34200
**Johnson, M.M.,** *See* Turner, W.D., 6:33124
**Johnson, R.,** *See* Selkowitz, S., 6:33453
**Johnson, R.T. Jr.,** Electrical conductivity and thermal decomposition of high temperature phenolic- and silicone-based materials, 6:33552 (SAND—81-0786C)
High temperature electrical conductivity and thermal decomposition of phenolic- and silicon-based dielectrics for fireset housings, 6:33560 (SAND—81-0786)
**Johnson, S.H.,** *See* Dissinger, G.R., 6:32852
**Johnson, T.E.,** *See* Hackley, D.S., 6:34087
**Johnson, W.G.,** Management Oversight and Risk Tree - MORT, 6:33918 (DOE/ID/01375—T1)
**Joiner, J.,** *See* Clark, J., 6:33255, 6:33256
**Jolliffe, V.C.,** Finite element analysis of the stress intensity factors of cracks in welded transition joints, 6:33327 (R/M/R—263)
Thermal cycling behavior of a cracked transition joint between austenitic and ferritic steels welded with austenitic weld metal, 6:33328 (R/M/R—271)
*See* Hepworth, J.K., 6:33325
**Jones, C.M.,** *See* Auble, R.L., 6:34010
**Jones, E.M.,** Effect of stellar structure on supernova remnant evolution, 6:33947
**Jones, J.,** *See* Bailey, A., 6:33782
**Jones, J.E. Jr.,** *See* Kermode, R.I., 6:32848
**Jones, J.W.,** *See* Jenkins, C.E., 6:33638
**Jones, R.F.,** *See* Ghaffari, H.T., 6:33158
**Jones, R.H.,** Relative effects of S, Sb and P on the intergranular fracture of iron and nickel tested at cathodic potentials, 6:33531 (PNL-SA—9446)
**Jones, T.L.,** *See* Gee, G.W., 6:33804
**Jones, W.D.,** Comparative reactivities of two isoelectronic transition-metal hydrides with transition-metal carbonyls and alkyls, 6:33594
**Jones, W.M.,** Use of oxide decompositions in advanced thermochemical hydrogen cycles for solar heat sources. Application of the tricobalt tetraoxide-cobalt monoxide pair, 6:33074 (LA-UR—81-2628)
**Joshi, J.B.,** *See* Slagle, D., 6:32838
**Joshi, S.V.,** Solubility of hydrogen in coal liquids, 6:32830 (DOE/OR/03054—3, pp 225-230)
**Jostlein, H.,** *See* Koepke, K., 6:33676
**Judd, B.R.,** *See* Borison, A.B., 6:33424, 6:33425, 6:33426
**Julian, E.L.,** Reclamation in the big sky, 6:32957 (ANL/LRP-TM—20, pp 79-91)
**Jung, J.,** Importance of shield design in minimizing radioactive material inventory in tokamaks, 6:34094 (CONF-801011—(Vol.1), pp 458-463)
**Justus, C.G.,** *See* Mikhail, A.S., 6:33236

# K


**Kadlec, E.,** Wind turbine, 6:33247
**Kaelne, J.,** Two-nucleon pion absorption in $^{3}sup(,)^{4}$He, 6:33999
**Kahana, S.,** *See* Barrette, J., 6:33996
**Kalibjian, R.,** *See* Wang, C.L., 6:34072
**Kalra, S.P.,** Loss-of-feed water transients in PWR U-tube steam generators: simulation experiments and analysis, 6:33367
**Kamil, H.,** Seismic evaluation of the headframe structure and the cable/hoist system, 6:33032 (DPST—81-262, pp 11p, Paper 8)
**Kammerud, R.,** *See* Andersson, B., 6:33172
*See* Sullivan, P.W., 6:33173
**Kamzelski, A.Z.,** *See* Kingsley, I.S., 6:32828
**Kanapilly, G.M.,** *See* Cheng, Y.S., 6:33704
**Kanipe, L.G.,** *See* Raines, W.L., 6:33799
**Kanno, M.,** *See* Tanaka, S., 6:34098
**Kanofsky, J.R.,** *See* Streuli, R.A., 6:33855
**Kao, Y.K.,** *See* Weisman, J., 6:33349
**Kaplan, T.,** Self-consistent approximation beyond the CPA: Part II, 6:33506 (CONF-810866—1(Draft))
**Kappenman, J.G.,** Investigation of geomagnetically induced currents in the proposed Winnipeg-Duluth-Twin Cities 500-kV transmission line. Final report, 6:33279 (EPRI-EL—1949)
**Karas, B.R.,** Luminescent photoelectrochemical cells. 5: multiple emission from tellurium-doped cadmium sulfide photoelectrodes and implications regarding excited state communication, 6:33105 (A—093692)
**Karnitz, M.A.,** *See* Gant, R.E., 6:33479
**Karpenko, V.N.,** Mirror fusion test facility-B, 6:34157 (CONF-801011—(Vol.3), pp 976-984)
**Kasameyer, P.,** Comparative assessment of five potential sites for magma: hydrothermal systems - geophysics, 6:33221 (UCRL—52980)
**Kasha, H.,** *See* Leipuner, L.B., 6:33688
*See* Morse, W.M., 6:33965
**Kasperek, K.,** *See* Iyengar, G.V., 6:33845, 6:33880
**Kaszeta, F.E.,** *See* Gupta, S.K., 6:33053
**Katz, E.M.,** Proceedings of the Power Plant Dynamics, Control and Testing Symposium, 4th, 1980, 6:33334
**Kavanaugh, J.P.,** *See* Dinwoodie, T.L., 6:33097
**Kawanishi, H.,** *See* Ishino, S., 6:34128
**Kawin, R.A.,** *See* Prater, L.S., 6:33374
**Kay, M.A.,** In situ determination of transuranic and fission product radionuclides, 6:33798 (CONF-800433—, pp 524-533)
**Keefe, D.,** *See* Faltens, A., 6:34110
**Keegan, P.J.,** *See* Davis, A., 6:33448
**Keeney, T.A.,** Valuation of surface mining design to improve post-mining land resources, 6:32886 (ANL/LRP-TM—20, pp 123-146)
**Kendig, M.W.,** *See* Isaacs, H.S., 6:33610
**Kendrick, H.,** NASAP and INFCE: the final reports, 6:33321
**Kendrick, S.,** *See* Sargent, G.A., 6:32936
**Kennett, R.G.,** Inclusive $\pi^0$ and eta production from kaon, proton and antiproton beams in the triple-Regge region, 6:33972
**Kenney, R.W.,** *See* Kennett, R.G., 6:33972
**Kermode, R.I.,** Comparison of independent product cost estimates: the cost of methanol from coal, 6:32848
**Kerst, D.W.,** Crossed-field divertor for a plasma device, 6:34192
**Kessel, C.,** *See* Wong, C.P.C., 6:34146
**Kessler, G.,** *See* Abdel-Khalik, S.I., 6:34103
**Kessler, R.C.,** Continuous analyzer system for in-situ coal gasification project, 6:32854
**Kestin, J.,** *See* Bilicki, Z., 6:33226
**Khalil, S.R.,** Studies of Oxygen and Nitrogen in coal conversion liquids by 14 MeV INAA, 6:33816 (CONF-800433—, pp 636-644)
**Khatibloo, M.A.,** Indentation and erosion of brittle materials, 6:33548 (LBL—11883)
**Khoo, T.L.,** Yrast spectroscopy: status of yrast isomers, oblate shapes and feeding of yrast states, 6:34015
**Kidman, R.B.,** ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)
**Kidnay, A.J.,** Enthalpy measurement of coal-derived liquids. Technical progress report, May-July 1981, 6:32860 (DOE/PC/40787—1)
**Kidybinski, A.,** Method of investigations, estimation, and classification of roofs in mines in the United States of America for the selection of suitable mechanized support for longwalls. Report No. 1: January 1, 1977-March 31, 1977, 6:32910 (DOE/TIC—11477)
**Kim, J.J.,** *See* Pitzer, K.S., 6:33602
**Kim, K.C.,** Diode laser spectroscopy of the transient $UF_5$ radical following laser photolysis of $UF_6$, 6:33958
**Kimball, R.F.,** Critical review of the mutagenic and other genotoxic effects of direct coal liquefaction, 6:33912 (ORNL—5721)
**Kimmich, G.A.,** Gradient coupling in isolated intestinal cells, 6:33853
**Kincaid, C.T.,** *See* Gupta, S.K., 6:33053
**Kindle, C.H.,** Techniques for geothermal liquid sampling and analysis, 6:33220 (PNL—3801)
**King, D.S.,** *See* Cogan, B.C., 6:33933
*See* Cox, J.P., 6:33943
*See* Hodson, S.W., 6:33942
**King, L.J.,** Current status of the transuranium processing plant, 6:33625
**King, W.J.,** Development of simplified process for environmentally resistant cells. Final report, 8 Jun. 1978 - 30 Nov. 1980, 6:33144 (NASA-CR—163884)
**Kingsley, I.S.,** Development of SRC-1 product analysis, 6:32828 (DOE/OR/03054—3, pp 139-149)
**Kinlen, P.J.,** *See* Kessler, R.C., 6:32854
**Kirkpatrick, R.C.,** Evidence for planetary progenitor rotation and for the long term acceleration of the ejected nebular shell, 6:33938
**Kissel, L.,** Bremsstrahlung energy spectra from electrons of kinetic energy 1 keV $\leqq$ T $\leqq$ 2000 keV incident on neutral atoms 1 $\leqq$ Z $\leqq$ 92, 6:33959 (SAND—81-1337)
**Kittel, J.H.,** *See* Walters, L.C., 6:33316
**Kiyose, R.,** *See* Tanaka, S., 6:34098
**Klebesadel, R.W.,** *See* Fenimore, E.E., 6:33937
**Klein, W.H.,** Climatological relationships between monthly mean surface temperature and mid-tropospheric heights. Progress report, November 1, 1980-June 30, 1981, 6:33721 (DOE/EV/10539—T1)
**Klems, J.,** *See* Berman, S., 6:33454
*See* Selkowitz, S., 6:33453
**Klosek, J.,** Cryogenic methane separation/catalytic hydrogasification process analysis. Quarterly report, 6:32811 (DOE/ET/10325—T11)
**Klumpp, P.,** *See* Abdel-Khalik, S.I., 6:34103
**Kmetyk, L.N.,** Effect of cyclic pulsed temperature on void growth in metals during irradiation, 6:33522 (LA-UR—81-2437)
**Knight, D.D.,** *See* Henderson, J.M., 6:33354
**Knight, H.G.,** *See* Skelly, J.M., 6:33907
**Knight, R.A.,** Investigation of novel coal-preparation techniques, 6:32941
**Kniseley, R.N.,** *See* Haas, W.J. Jr., 6:32861
*See* Lembke, L.L., 6:33763
**Knoll, J.,** *See* Bohrmann, S., 6:33971
**Knoth, J.,** *See* Schwenke, H., 6:33815
**Knox, W.,** Picosecond high-power switching at the Los Alamos National Laboratory, 6:33698 (LA—8720)
**Kobayashi, S.,** In-situ electron microscope fracture studies of amorphous films, 6:33545 (CONF-810851—2)
**Kocamustafaogullari, G.,** General formulation of an HCDA bubble rising in a sodium pool and the effect of nonequilibrium on fuel transport, 6:33344 (DOE/ET/37227—T1)
**Koehler, D.E.,** Maximizing efficiency of fuel production and utilization, 6:33489
**Koenig, B.A.,** Hawthorne study area, 6:33215 (DOE/NV/10039—3, pp 11-82)
*See* Trexler, D.T., 6:33207
**Koenig, L.R.,** Anomalous snowfall caused by natural-draft cooling towers, 6:33723 (ORNL/TM—7744, pp 49-79)
**Koepke, K.,** Two cell double systems test, 6:33676
**Koetke, D.,** *See* Derrick, M., 6:33973
**Koetzle, T.F.,** *See* Engel, D.W., 6:34018
**Kohl, F.J.,** *See* Lowell, C.E., 6:33509
**Kohn, S.E. Rosenblum, S.S.,** *See* Clawson, C.W., 6:33957
**Kohyama, A.,** *See* Igata, N., 6:34127
**Kolar, C.A.,** *See* Ashby, W.C., 6:32882
**Kolb, E.W.,** Neutrino number of the universe, 6:33934 (LA-UR—81-2505)
**Kolecki, J.C.,** Commerical (terrestrial) and modified solar array design studies for low cost, low power space applications, 6:33134 (NASA-TM—81622)
**Kono, H.O.,** Heat-supply system for a fluidized-bed reactor featuring an endothermic reaction, 6:32977
**Koo, H.H.,** *See* Hoffmann, M.R., 6:33871
**Koppe, R.H.,** Potential contribution of currently operating nuclear-fueled electric-generating units to reducing US oil consumption, 6:33392 (ORNL/Sub—80/40416/1)
**Koppel, L.,** *See* Charatis, G., 6:34061
**Koppenaal, D.W.,** *See* Khalil, S.R., 6:33816
**Korenko, M.K.,** *See* Bates, J.F., 6:33340

**Kost, G.,** *See* Kamil, H., 6:33032
**Koszykowski, R.F.,** *See* Ondov, J.M., 6:33762
**Kot, C.A.,** *See* Youngdahl, C.K., 6:33364
**Kotwal, R.,** New approach for erosion prediction due to fly ash, 6:33267
**Kovalenko, L.J.,** *See* Richardson, J.H., 6:33614
**Kovar, F.R.,** High-explosive detonations in varying-oxygen atmospheres, 6:33716 (UCRL—86563)
**Kozlowski, O.,** Removal and recovery of fine size coal from coal preparation plant waters. Report No. 1: January 1, 1977-December 31, 1977, 6:32924 (DOE/TIC—11482)
**Kraemer, F.W.,** Total program approach to freeze conditioning: experiences of Toledo Edison, 6:32937 (EPRI-WS—79-236, pp 10.1-10.19)
**Kraft, G.,** Analysis of non-metals in metals, 6:33543
**Krajewski, R.F.,** *See* McDonald, R.J., 6:33446
**Krakowski, R.A.,** *See* Bathke, C.G., 6:34165
**Kramer, C.M.,** Corrosion of Fe alloys in NaNo/sub 3/-KNO/sub 3/-NaNO/sub 2/ at 823 K, 6:33148
**Kramer, J.M.,** Modeling deformation and failure of fast reactor cladding during simulated accident transients, 6:33365
**Kramer, M.J.,** Finite element analysis of the split Hopkinson bar, 6:34044 (LA—8921-MS)
**Kramlich, J.,** *See* England, G., 6:33743
**Krapels, E.N.,** Preparing for an oil crisis: elements and obstacles in crisis management, 6:33403
**Krien, K.,** *See* Girshick, F., 6:34026
**Krikorian, O.,** *See* Shell, P., 6:33077
**Krikorian, O.H.,** Hydrogen production based on magnetic fusion, 6:33065 (UCRL—86600)
Predictive calculations of volatilities of metals and oxides in steam-containing environments, 6:33055 (UCRL—85553)
Solar furnace study of zinc sulfate decomposition, 6:33076 (UCRL—86622)
**Krill, W.V.,** Kinetics of NO/sub x/ formation during early stages of pulversized-coal combustion. Third quarterly report, 4 April 1981-30 June 1981, 6:32945 (DOE/PC/30295—3)
**Krishnan, R.P.,** *See* Wells, J.W., 6:33265
**Kroeger, H.,** Finite region density increase effects in the Lee-Wick model, 6:34034
**Krohn, D.,** *See* Kraemer, F.W., 6:32937
**Krohta, B.J.,** *See* Hill, F.E., 6:32906
**Kronenberg, A.,** *See* Ettinger, K.V., 6:33906
**Krumpelt, M.,** *See* Bates, J., 6:33540
**Kruse, G.S.,** *See* Hackley, D.S., 6:34087
**Kuchnir, M.,** *See* Koepke, K., 6:33676
**Kuemmerle, N.,** Analysis of resynthesis tracts in repaired Escherichia coli deoxyribonucleic acid, 6:33899
**Kuesel, T.R.,** Seismic design considerations for underground nuclear facilities, 6:33348 (DPST—81-262, pp 4p, Paper 7)
**Kuhlow, W.W.,** Laboratory and field portable system for calibrating airborne multispectral scanners, 6:33697 (EGG—1183-1777)
**Kulcinski, G.L.,** Critical materials problems in INTOR, 6:34129 (CONF-801011—(Vol.2), pp 1690-1701)
**Kulkarny, V.A.,** Pressure wave charged repetitively pulsed gas laser, 6:33651
**Kumar, R.A.,** Thermal performance analysis of an MHD simulation test facility, 6:33436
**Kumar, V.,** Engineering approach for elastic-plastic fracture analysis, 6:33510 (EPRI-NP—1931)
**Kurkowski, T.L.,** Performance predictions of passive solar commercial buildings, 6:33161 (CONF-811034—1)
**Kurtz, D.M. Jr.,** *See* Murphy, P.D., 6:33582
**Kutzman, R.S.,** Toxicokinetic studies possible after acute inhalation administration of compounds labeled with short-lived isotopes, 6:33904 (CONF-800433—, pp 369-377)
**Kwan, Y.,** *See* England, G., 6:33743

## L

**La Mar, G.N.,** Analysis of field-dependent relaxation data and hyperfine shifts of cytochrome c′ from Rhodospirillum rubrum in terms of the high-spin iron ligation states, 6:33593
**LaBelle, S.J.,** *See* Moses, D., 6:33395
**Lacelle, S.,** *See* Murphy, P.D., 6:33582
**Lackey, M.E.,** *See* Daw, C.S., 6:32948
**LaGuardia, T.S.,** *See* Jenkins, C.E., 6:33638
**Lakshmi, G.J.,** *See* Venkataramiah, A., 6:33909
**Lam, H.K.,** *See* Shenton, L.R., 6:34199
**Lama, R.D.,** Results of some index tests on coal at Cook Colliery, Queensland Coal Mining Company, Blackwater, Queensland, 6:32863
**Lambert, J.E.,** *See* Grisham, D.L., 6:33671
**Lamoreaux, R.H.,** *See* Allam, I.M., 6:33306
**Lampert, C.,** *See* Selkowitz, S., 6:33453
**Land, C.E.,** Effects of ion implantation on the photoferroelectric properties of lead lanthanum zirconate titanate ceramics, 6:33561 (SAND—81-1834C)
**Landrum, J.H.,** *See* Nitschke, J.M., 6:34031
**Landsberg, H.H.,** Selected studies on energy; background papers for energy: the Next Twenty Years, 1980, 6:33400
**Lane, B.H.,** *See* Berger, C.D., 6:33361
**Lane, G.J.,** Studies of in-bed corrosion in a pressurized fluidized-bed combustor. Final report, 6:33660 (EPRI-CS—1935)
**Lang, J.M.,** Anti-pollution solid waste burning incinerator, 6:33481
**Langeliers, J.,** *See* Ochs, T., 6:33192
**Lanier, R.G.,** *See* Girshick, F., 6:34026
**Lappi, R.L.,** *See* Carey, D.I., 6:32890
**Laros, J.G.,** *See* Fenimore, E.E., 6:33937
**Larsen, R.,** *See* Leipuner, L.B., 6:33688
**Larsen, R.C.,** *See* Morse, W.M., 6:33965
**Larson, D.E.,** *See* Eaton, R.R., 6:33054
**Laslett, L.J.,** *See* Faltens, A., 6:34110
**Lassila, K.E.,** *See* Carlson, C.E., 6:33980
**Lau, F.S.,** *See* Paganessi, J.E., 6:32846
*See* Pyrcioch, E.J., 6:32845
**Laughlin, A.W.,** *See* Goff, F.E., 6:33219
**Laul, J.C.,** Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Lawrence, G.R.,** *See* Calloway, N.E., 6:33353
**Le, G.,** *See* Zhu, Y., 6:32974
**Le, T.,** Solid-waste impacts of increased coal utilization, 6:32865 (BNL—24786)
**Leber, R.E.,** *See* Nitschke, J.M., 6:34031
**LeCren, R.T.,** *See* White, D.J., 6:32951
**Ledger, P.,** *See* Mallett, C.W., 6:32914
**Lee, A.Y.,** Neutronic and thermal performance of a blanket design for an inertially confined fusion commercial power reactor, 6:34141 (CONF-801011—(Vol.3), pp 654-663)
**Lee, E.,** *See* Helm, F.H. Jr., 6:33714
**Lee, J.D.,** *See* Berwald, D.H., 6:34117
**Lee, J.K.,** *See* Chu, M.S., 6:34059
**Lee, R.W.,** Using spectral line profiles as a diagnostic of the plasma electron density, 6:34071 (UCID—19173)
**Lee, S.H.D.,** Studies of the regeneration of activated bauxite used as granular sorbent for the control of alkali vapors from hot flue gas of coal combustion, 6:33269 (ANL/CEN/FE—81-1)
**Lee, W.R.,** Progress report for mutagenic effect of radionuclides incorporated into DNA of Drosophilia melangaster, 6:33887 (DOE/EV/03728—T1)
**Lees, D.J.,** *See* Johnson, J.L., 6:34182
**Lees, R.,** *See* Enever, J.R., 6:32901
**Legate, A.C.,** *See* Hasibar, R.M., 6:33283
**Leino, M.E.,** *See* Nitschke, J.M., 6:34031
**Leipuner, L.B.,** Plans for Brookhaven Fastbus during the next $\pi \times 10^{16}$ nanoseconds, 6:33688 (BNL—30031)
*See* Morse, W.M., 6:33965
**Lemaire, M.C.,** *See* Tanihata, I., 6:34008
**Lembke, L.L.,** Precision of the all-glass impinger and the Andersen microbial impactor for air sampling in solid-waste handling facilities, 6:33763
**Lenihan, J.M.A.,** Chemist in the clinic, 6:33882 (CONF-800433—, pp 354-359)
**Leon, A.M.,** Fluidized-bed-fired industrial boilers, 6:33663
**Leonard, B.R. Jr.,** Activation of containment atmospheres in DT fusion facilities, 6:34095 (CONF-801011—(Vol.1), pp 464-469)
**Lepel, E.A.,** *See* Laul, J.C., 6:33581
**Lerche, R.A.,** Streak camera measurements of laser pulse temporal dispersion in short graded-index optical fibers, 6:34185 (UCID—19176)
**Lerner, S.L.,** Multicomponent fuel droplet vaporization at large Reynolds numbers, 6:33627
**Leung, D.C.,** *See* Yoo, H.I., 6:33111
**Leveson, S.M.,** Effect of the prospective investment climate on future oil and gas supplies from foreign sources, 6:33410 (EPRI-WS—79-182, pp 3.6.1-3.6.13)
**Levine, J.D.,** TFTR safety approaches, 6:34106 (CONF-801011—(Vol.2), pp 1278-1281)
**Levine, M.D.,** *See* Craig, P., 6:33399
**Levman, G.,** *See* Derrick, M., 6:33973
**Levy, A.,** CaO interactions in the staged combustion of coal. Third quarterly technical progress report, April 1, 1981-June 30, 1981, 6:32946 (DOE/PC/30301—3)

**Levy, D.,** *See* Harte, J., 6:33821, 6:33911
**Lewis, A.E.,** Lawrence Livermore National Laboratory Oil-Shale Project. Quarterly report, April-June 1981, 6:32994 (UCID—16986-81-2)
**Lewis, J.B.,** *See* Smart, J.E., 6:33874
**Lewis, R.I.,** Performance analysis for horizontal axis wind turbines applicable to variable pitch or airbrake control, 6:33249
**Lewis, T.A.,** *See* Christian, O.W., 6:33672
**Ley, R.,** *See* Kuemmerle, N., 6:33899
**Li, X.,** *See* Hou, X., 6:33662
**Liberman, I.,** *See* Viswanathan, V.K., 6:34176
**Lichtenberg, A.J.,** Fermi acceleration revisited, 6:33951
**Liebermann, M.A.,** *See* Lichtenberg, A.J., 6:33951
**Lilien, G.L.,** Photovoltaic market analysis program: background, model development, applications and extensions, 6:33098 (MIT-EL—81-012)
*See* Fuller, F.H., 6:33132
**Lin, F.,** *See* Hou, X., 6:33662
**Lin, N.H.,** *See* Chang, S.G., 6:32878
**Lind, K.E.,** *See* Levine, J.D., 6:34106
**Lind, M.A.,** *See* Hartman, J.S., 6:33116
**Lindemer, T.B.,** Chemical thermodynamic analysis of the interaction of 304 SS with the gases and the $CaSO_4$ deposit in the fluidized-bed combustor, 6:33507 (CONF-810943—2)
**Lindemuth, I.R.,** *See* Brownell, J.H., 6:34062
**Lindenbaum, S.J.,** Multiparticle magnetic spectrometer with dE/dx and TRD particle identification, 6:33669 (BNL—29990)
QCD, OZI, and evidence for glueballs, 6:33985 (BNL—29768)
**Lindstrom, R.M.,** Accuracy in activation analysis: count rate effects, 6:33773 (CONF-800433—, pp 25-35)
**Ling, J.S.,** *See* Reid, M.A., 6:33441
**Lipfert, F.W.,** Assessment methodology for the air quality impact of residential wood burning, 6:33445 (BNL—29763)
**Lipkin, H.J.,** *See* Cohen, I., 6:33990
**Lipner, M.H.,** Analysis by hybrid computer simulation of a power level control system for a tokamak fusion reactor plasma, 6:34081 (CONF-801011—(Vol.1), pp 207-224)
**Lippmann, M.J.,** *See* Bodvarsson, G.S., 6:33212
**Lipps, F.W.,** Numerical approach to the flux density integral for reflected sunlight, 6:33200
**Lipscomb, W.O.,** Survey of particulate emission macro- and micro-sampling and sizing methods and real-time monitoring and sizing methods, 6:33742 (DOE/FC/10193—T1)
**Lisowski, P.,** *See* Drosg, M., 6:33695
**Little, J.B.,** Influence of noncarcinogenic secondary factors on radiation carcinogenesis, 6:33896
**Little, R.,** *See* Citrolo, J., 6:34164
*See* Jassby, D.L., 6:34147
**Littlejohn, D.,** *See* Chang, S.G., 6:32878
**Liu, C.,** *See* Inouye, H., 6:33536
**Liu, S.,** Technology of strengthening the power transmission chains for oilfield drilling rigs, 6:32975
**Liu, Y.Y.,** Analysis of stresses in GCFR cladding under normal operating conditions, 6:33307
**Livio, M.,** *See* Buchler, J.R., 6:33946
**Lo, C.Y.,** Radiation reaction force and unification of electromagnetic and gravitational fields, 6:33988 (DOE/ER/03023—T1)
**Locke, F.E.,** *See* Quong, R., 6:33223
**Lockett, G.,** *See* Harte, J., 6:33822
**Loehman, R.E.,** *See* Allam, I.M., 6:33306
**Logan, B.G.,** *See* Baldwin, D.E., 6:34190
**Lokmankekim, M.,** *See* Curtis, R., 6:33455
**Lombard. G.L.,** Design guide for Geothermal Test Facility, 6:33224 (DOE/ET/28443—T15)
**Long, C.A.,** Rate of reaction of superoxide radical with chloride-containing species, 6:33598
**Long, C.J.,** Structural materials for large superconducting magnet systems: an assessment based on the large coil program, 6:34136 (CONF-801011—(Vol.2), pp 1817-1824)
**Longacre, R.S.,** *See* Lindenbaum, S.J., 6:33669
**Lontai, L.M.,** *See* Jassby, D.L., 6:34147
**Loomis, B.A.,** Similar dependence on dilute O concentration of void formation in ion-irradiated Nb and some properties of unirradiated Nb, 6:33539
**Loomis, H.H.,** Clock distribution system for digital computers, 6:33656
**Lorz, H.V.,** *See* Beasley, T.M., 6:33888
**Loth, J.L.,** *See* Carpenter, L.K., 6:32952
**Lougheed, R.W.,** *See* Hulet, E.K., 6:34029, 6:34030
**Love, J.D.,** *See* Reynolds, R.J., 6:33901
**Loveland, W.D.,** Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**Lovell, A.J.,** In-reactor creep rupture of 20% cold-worked AISI 316 stainless steel, 6:33535
**Lovhoiden, G.,** *See* Burke, D.G., 6:34022
**Lowell, C.E.,** Effects of trace impurities in coal-derived liquid fuels on deposition and accelerated high-temperature corrosion of cast superalloys, 6:33509 (DOE/NASA/2593—22)
**Lowry, W.E.,** Effects of annular air gaps surrounding an emplaced nuclear waste canister in deep geologic storage, 6:33044
**Lu, M.G.,** Source of oil for the western part of the Tarimu Basin, 6:32964
**Luhman, T.S.,** *See* Okuda, S., 6:33501
*See* Suenaga, M., 6:33502
*See* Thadani, V., 6:33499
**Lukas, R.W.,** *See* Diaz-Tous, I.A., 6:32925
**Lunardini, V.J.,** Effects of ice on coal movement via the inland waterways. Special report 81-13, 6:33404 (DOE/ET/14356—T1)
**Lundy, R.A.,** State of the energy doubler, 6:33675
**Lunke, C.,** *See* Egger, J.P., 6:34014
**Lupton, G.T.,** *See* Enever, J.R., 6:32917
**Luttmann, F.,** *See* Fazzolare, R., 6:33167
**Lutwack, R.,** *See* Sah, C.T., 6:33123
**Lutz, G.R.,** *See* Graumann, D.W., 6:34107
**Luzzi, T.,** Poloidal divertor target for SLPX, 6:34142 (CONF-801011—(Vol.3), pp 664-673)
**Lynch, F.E.,** Hydride chemical compressor. Phase I, final report, 6:33631 (BNL—51369)
**Lynch, J.F.,** Solution of hydrogen in $TaV_2$, 6:33542
**Lynn, K.G.,** Slow positrons in the study of surface and near-surface defects, 6:33953 (BNL—29798)
**Lyon, W.S.,** Nuclear methods in coal research, 6:33776 (CONF-800433—, pp 587-596)
**Lysmer, J.,** Computation of seismic wave fields and soil-structure interaction, 6:33927 (DPST—81-262, pp 5p, Paper 5)
**Lytle, J.M.,** Kinetics of coal liquefaction: effect of catalyst, H/sub 2/ concentration and coal type, 6:32849

## M

**Ma, D.,** *See* Ahmed, H.U., 6:33339
*See* Zhang, X., 6:33645
**Ma, H.H.,** *See* Chan, S.H., 6:33346
**Mac Mahon, T.D.,** *See* Ahmad, A., 6:33731
**MacCallum, C.,** *See* Kissel, L., 6:33959
**Macwani, M.,** *See* Ahmad, A., 6:33731
**Maddigan, R.J.,** ORNL rural electric-energy-demand forecasting model, 6:33427 (ORNL/TM—7863)
**Madron, F.,** Determination of specific consumption of raw materials and energy in the chemical industry, 6:33472
**Maenhaut, W.,** Application of PIXE and INAA to biological materials: analysis of serum and serum albumin, 6:33844 (CONF-800433—, pp 378-387)
**Maestas, S.,** *See* Thompson, J.L., 6:33797
**Maestre, M.F.,** Contribution of light scattering to the circular dichroism of deoxyribonucleic acid films, deoxyribonucleic acid-polylysine complexes, and deoxyribonucleic acid particles in ethanolic buffers, 6:33599
**Magerl, A.,** Phonons in graphite intercalation compounds measured by neutron scattering, 6:33557 (DOE/ER/01198—1354)
**Maggi, L.,** Approach to Cadmium speciation in natural waters using $^{109}Cd$ as radiotracer, 6:33818 (CONF-800433—, pp 729-741)
*See* Ganzerli Valentini, M.T., 6:33812
**Maggiora, G.M.,** *See* Petke, J.D., 6:33609
**Maguire, J.,** *See* Packer, L., 6:33854
**Mahajan, S.M.,** *See* Ross, D.W., 6:34057
**Mahler, J.P.,** *See* Helm, F.H. Jr., 6:33714
**Mahone, D.,** *See* Sullivan, P.W., 6:33173
**Mahr, D.,** *See* Morgan, J., 6:32933
**Majkrzak, C.F.,** Polarizing multilayer spectrometer for neutrons, 6:34036 (BNL—29922)
**Majumdar, S.,** Designing against low-cycle fatigue at elevated temperature, 6:33315
**Makowiecki, D.,** *See* Leipuner, L.B., 6:33688
**Mall, G.H.,** *See* Singh, J.J., 6:33789
**Mallard, J.R.,** *See* Ettinger, K.V., 6:33838
**Mallett, C.W.,** Basic program for borelog coding of coal-measure sequences using microcomputers, 6:32900

Depositional environments in the Barabala Coal Measures: Moura, Queensland, 6:32914
**Malone, B.,** *See* Wykle, R.L., 6:33850
**Malone, J.L.,** *See* Ohnesorge, W.F., 6:33803
**Maloney, K.L.,** Overview of major causes of pulverizer failures, 6:32935 (EPRI-WS—79-236, pp 8.1-8.22)
**Malterer, T.J.,** *See* Severson, L.S., 6:32896
**Mangelson, N.F.,** *See* Hill, M.W., 6:33775
**Maniscalco, J.A.,** *See* Berwald, D.H., 6:34115, 6:34117
**Mann, F.M.,** Neutron environment in d + Li facilities, 6:34173 (HEDL-SA—2340FP)
*See* Bates, J.F., 6:33514
**Mann, L.G.,** *See* Girshick, F., 6:34026
**Manuel, E.H.,** *See* Hill, F.E., 6:32906
**Marciano, W.J.,** Neutrino masses: theory and experiment, 6:33977
**Marinacci, D.J.,** Thermodynamic behavior of compressed air energy storage systems, 6:33368 (DOE/OR/90337—T1)
**Mark, J.,** *See* Faltens, A., 6:34110
**Markesbery, W.R.,** *See* Ehmann, W.D., 6:33879
**Markowitz, S.,** *See* Brodzinsky, R., 6:33747
*See* Clemenson, M., 6:33579
*See* Cohen, S., 6:33752
*See* McKinney, M., 6:33580
*See* Oblath, S., 6:33749
**Marlow, W.,** *See* Wegrzyn, J., 6:32805, 6:32806
**Marom, G.,** *See* Diamant, Y., 6:33607
**Marshall, W.F.,** *See* Koehler, D.E., 6:33489
**Marston, K.,** *See* Trauth, C.A. Jr., 6:33920
**Marston, T.U.,** *See* Nickell, R.E., 6:33289
**Martin, B.,** *See* Diesendorf, M., 6:33238
**Martin, F.J.,** *See* Ferrell, P.C., 6:33355
**Martin, J.D.,** *See* Kraemer, F.W., 6:32937
**Martin, J.G.,** *See* Sheff, J.R., 6:33066
**Martin, J.T.,** *See* Schmidt, T.R., 6:33338
**Martin, S.B.,** *See* Alger, R.S., 6:33717
**Martin, T.W.,** *See* Cwik, M.J., 6:32888
**Martinez, P.F.,** *See* Warren, W.E., 6:33932
**Martino, F.J.,** *See* Barney, D.L., 6:33376
**Marusic, M.,** Genetic constraints in the induction of the immune response to Ehrlich ascites tumor in mice, 6:33902
**Maruska, H.P.,** *See* Ghosh, A.K., 6:33107
**Masand, A.C.,** 8 x 8 fuel surveillance program at Monticello - end of Cycle 3: first post-irradiation measurements, January 1975, 6:33292 (DOE/ET/34031—2)
**Mashburn, D.N.,** *See* Akerman, M., 6:33650
**Masker, W.,** *See* Kuemmerle, N., 6:33899
**Mason, C.F.V.,** Oxidation of metal sulfites by iodine for use in thermochemical hydrogen cycles, 6:33073 (LA-UR—81-2477)
**Massey, J.V.,** *See* Berwald, D.H., 6:34120, 6:34124
**Mathews, M.,** High-temperature logging for basic development of HDR reservoirs, 6:33218 (LA-UR—81-1765)
**Mathews, M.B.,** *See* Smart, J.E., 6:33874
**Mathur, P.,** Improved effectiveness of solar repowering in the utilities with high coal generation, 6:33140 (ATR—80(7873)-4)
**Matsumoto, M.,** *See* Terai, M., 6:33878
**Matsumoto, W.Y.,** *See* Daubert, R.L., 6:33336
**Matthews, D.L.,** *See* Charatis, G., 6:34061
*See* Howell, R.H., 6:34050
*See* Lee, R.W., 6:34071
**Matthews, G.E.,** *See* Crawford, J.H. Jr., 6:33601
**Mattice, J.S.,** Comparative toxicity of hypochlorous acid and hypochlorite ions to mosquitofish, 6:33915
**Mattox, D.M.,** *See* Whitley, J.B., 6:34134
**Mattroc, C.F.,** Organic groundwater contaminants from UCG, 6:32853
**Maudlin, P.J.,** Thermal-hydraulic differential sensitivity theory, 6:33312 (ORNL/CSD/TM—126)
**Maule, P.A.,** *See* Wade, J.E., 6:33237
**Mause, P.,** Price regulation and energy policy, 6:33430
**Maxwell, B.E.,** *See* Collins, C.J., 6:33606
**May, C.E.,** *See* Philipp, W.H., 6:33616
**Mayer, F.J.,** *See* Charatis, G., 6:34061
**Maynard, C.W.,** *See* Perry, R.T., 6:34096
**Maziasz, P.J.,** Preirradiation microstructrual development designed to minimize properties degradation during irradiation in austentic alloys, 6:33505 (CONF-810831—11)
*See* Scott, J.L., 6:34126
**Mazzucchi, R.P.,** *See* Watts, R.L., 6:33135
**McBreen, J.,** Investigation of the zinc electrode reaction. Annual report, October 1, 1979-September 30, 1980, 6:33377 (BNL—51370)
**McCarthy, D.R.,** *See* Setlow, J.K., 6:33858
**McCarville, M.E.,** *See* Houser, T., 6:32944
**McClelland, J.,** *See* Kaellne, J., 6:33999
**McClelland, J.F.,** Transwall: a modular visually transmitting thermal storage wall. Status report, 6:33169 (IS-M—345)
Transwall research, 6:33168 (IS-M—334)
**McClure, C.R.,** Damage to underground structures during earthquakes, 6:33925 (DPST—81-262, pp 5p, Paper 2)
**McCorkle, K.H. Jr.,** *See* Cheng, E.T., 6:33064
**McCormick, C.L.,** Improved polymers for enhanced oil recovery: synthesis and rheology. Third annual report, October 1979-September 1980, 6:32968 (DOE/ET/12038—T3)
**McCormick, N.J.,** *See* Ribe, F.L., 6:34125
**McCoy, D.E.,** *See* Leon, A.M., 6:33663
**McDaniel, P.,** *See* Nutt-Powell, T.E., 6:33100
**McDonald, B.S. Jr.,** *See* Jensen, B.L., 6:33807
**McDonald, R.J.,** Flame-retention head burner efficiency test results and analysis. Space-heating-equipment test program, 6:33446 (BNL—51321)
**McDougal, L.K.,** *See* Orrison, L.H., 6:33876
**Mcdowell, W.J.,** Salt-soda sinter process for recovering aluminum from fly ash, 6:32868
**McFadden, C.R.,** Analyses of the Pittsburgh coal seam from a northern West Virginia preparation plant, 6:32864
**McFarland, R.H.,** Laser isotope dating: a new technique of radioisotope dating using lasers, 6:33791 (CONF-800433—, pp 275-285)
**McGill, J.A.,** Inclusive proton spectra and total reaction cross sections for proton-nucleus scattering at 800 MeV, 6:33997 (LA—8937-T)
**McGrath, R.T.,** *See* Berwald, D.H., 6:34120
**McGreenery, P.A.,** *See* Horrigan, J.W., 6:32872
**McGuire, P.L.,** Power-law rheology and flow behavior of low-invasion coring fluids, 6:33230 (SAND—80-0933)
**McGuire, R.R.,** *See* Helm, F.H. Jr., 6:33714
**McHargue, C.J.,** Metals and Ceramics Division materials science program. Annual progress report for period ending June 30, 1981, 6:33529 (ORNL/TM—7970)
**McHugh, S.,** Small-scale experiments with an analysis to evaluate the effect of tailored pulse loading on fracture and permeability. Final report for Phase II, June 11, 1980-June 11, 1981, 6:32992 (DOE/MC/11577—T23)
**McKavanagh, B.M.,** Microseismic monitoring at 53 Level, West No. 2 mine, Collinsville: a feasibility study, 6:32919
**McKean, A.L.,** *See* Allam, E.M. Sr., 6:33284
**McKean, R.M.,** *See* Enever, J.R., 6:32917
**McKelvey, T.E.,** *See* Sevier, D.L., 6:34172
**McKeown, R.D.,** Comparison of pion and photon induced reactions on complex nuclei, 6:34001
**McKibben, J.M.,** *See* Gray, L.W., 6:33572
**McKinney, M.,** Determination of low-Z elements simultaneously by $^{3}$HE-induced nuclear wastes, 6:33580 (LBL—11986, pp 5.38-5.39)
**McLellan, E.J.,** Three-electrode low pressure discharge apparatus and method for uniform ionization of gaseous media, 6:33652
**McMillen, D.F.,** Coal structure cleavage mechanisms: scission of methylene and ether linkages to hydroxylated rings, 6:32844
**McMurry, R.E. Jr.,** *See* Chew, G.F., 6:33982
**McNeese, L.E.,** Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**McNeil, R.I.,** *See* Cronauer, D.C., 6:32834
**McWilliams, B.,** Estimation of the parameters of the distribution of wind speed and direction, 6:33250
**Meadows, J.W.,** High-current deuterium gas target for neutron nuclear data research, 6:34040
**Meakin, J.D.,** *See* Thornton, J.A., 6:33119
**Mecholsky, J.J.,** Toughening in glass ceramics through microstructural design, 6:33550 (SAND—81-0064C)
**Mehlhorn, R.,** *See* Packer, L., 6:33854
**Meiburger, P.F.,** *See* Reach, C.D. Jr., 6:33785
**Meier, M.M.,** User's guide to the hydrogen monitor, 6:33577 (LA—8957-MS)
**Meier, P.M.,** *See* Le, T., 6:32865
**Meisenhelder, J.,** *See* Bates, J., 6:33540
**Meloni, S.,** *See* Ganzerli Valentini, M.T., 6:33812
*See* Maggi, L., 6:33818
**Meng, B.,** *See* Liu, S., 6:32975
**Menlove, H.O.,** Application of the active well coincidence counter (AWCC) to high-enrichment uranium metal, 6:33060 (LA—8621-MS)
**Mensinger, M.C.,** *See* Paganessi, J.E., 6:32942

**Mercer, J.W.,** Review of simulation techniques for aquifer thermal energy storage (ATES), 6:33375 (PNL—3769)
**Mercer, R.W.,** *See* McClelland, J.F., 6:33169
**Mercer J.W.,** *See* Faust, C.R., 6:33210
**Merrill, O.S.,** *See* Morris, J.F., 6:33438
**Merryman, E.L.,** *See* Levy, A., 6:32946
**Meschi, D.J.,** Kinetics of dissociative vaporization reactions, 6:33604
**Meshii, M.,** Slip systems and solid solution softening/hardening in BCC metals, 6:33504 (CONF-810391—1)
**Metcalf, I.L.,** *See* Henderson, J.M., 6:33357
**Metz, D.J.,** Energy future: a primer for secondary school teachers, 6:33483 (BNL—51381)
**Meyer, G.J.,** *See* Kutzman, R.S., 6:33904
**Meyer, R.A.,** *See* Williams, R.E., 6:33787
**Meyers, R.E.,** *See* Ziegler, E.N., 6:33272
**Michael, M.D.,** Ultrasonic evaluation of U - 3/4 Ti penetrators by amplitude and frequency analysis, 6:33655 (RFP—3208)
**Michaelis, W.,** *See* Fanger, H.U., 6:33730
*See* Schwenke, H., 6:33815
**Migliore, P.G.,** Flow curvature effects on darrieus turbine blade aerodynamics, 6:33248
**Mignon, G.,** *See* Fazzolare, R., 6:33167
**Mikhail, A.S.,** Comparison of height extrapolation models and sensitivity analysis, 6:33236
**Mikkelsen, D.R.,** *See* Post, D.E., 6:34074
**Miles, C.R.,** *See* Wray, W.O., 6:33170
**Miles, D.J.,** *See* Mathews, M., 6:33218
**Miles, K.J.,** *See* Jensen, B.L., 6:33807
**Miley, G.H.,** Potential and status of alternate-fuel fusion, 6:34153 (CONF-801011—(Vol.3), pp 905-912)
*See* Gilligan, J.G., 6:34149
*See* Greenspan, E., 6:34154
*See* Nebel, R.A., 6:34054
*See* Sutton, W.R., 6:34052
**Miller, C.W.,** *See* Berger, C.D., 6:33361
**Miller, D.C.,** *See* Pew, R.W., 6:33333
**Miller, D.R.,** *See* Bledsoe, J.L., 6:33459
**Miller, E.L.,** *See* Hoffman, A.R., 6:33108
**Miller, G.E.,** Assessments of accuracy and precision of multi-element determinations in whole coal by non-destructive neutron activation analysis, 6:33778 (CONF-800433—, pp 604-611)
**Miller, H.H.,** *See* Alire, R.M., 6:34097
**Miller, R.C.,** *See* Hall, E.J., 6:33894
**Miller, R.J.,** Coal and ash handling in a typical industrial boiler plant, 6:33647
**Miller, R.L.,** *See* Patrinos, A.A.N., 6:33722
**Miller, W.J.,** *See* Mercer, J.W., 6:33375
**Mills, R.G.,** Fusion-fission hybrid reactors, 6:33320
**Mills, R.S.,** Experimental and theoretical study of a tall building subjected to wind loading, 6:33632 (CONF-810742—2)
**Milne, T.,** *See* Reed, T.B., 6:33121
**Milora, S.L.,** *See* Montgomery, D.B., 6:34079
**Minehart, R.C.,** *See* Kaellne, J., 6:33999
**Miner, F.J.,** Chemistry research and development. Annual progress report, November 1, 1979-October 31, 1980, 6:33622 (RFP—3180)
**Minnick, L.J.,** Development of potential uses for the residue from fluidized-bed-combustion processes. Quarterly technical progress report, March-May 1981, 6:33466 (DOE/ET/10415—T4)
**Minsk, L.D.,** *See* Lunardini, V.J., 6:33404
**Minski, M.J.,** *See* Ahmad, A., 6:33731
*See* Valente, I.M., 6:33793
**Mintz, J.M.,** Catalytic oxidation efficiencies for tritium and tritiated methane in a mature, industrial-scale decontamination system, 6:34100 (CONF-801011—(Vol.1), pp 555-559)
**Miola, U.,** *See* Ettinger, K.V., 6:33868
**Mischke, R.E.,** Future LAMPF experiments on lepton-number nonconservation, 6:33983 (LA-UR—81-2635)
*See* Egger, J.P., 6:34014
**Misra, B.,** *See* Morgan, G.D., 6:34143
**Missal, D.W.,** Solar energy system performance evaluation: Forest City Dillon, Washington, DC, January 1980-December 1980, 6:33187 (SOLAR/1041—81/14)
**Mitchell, H.A.,** Failure modes and effects analysis of a coal-slurry preheater, 6:32841 (ORNL/TM—7664)
**Miya, K.,** Structural dynamics of toroidal field coil in magentic fusion reactor, 6:34085 (CONF-801011—(Vol.1), pp 261-269)*
**Miyajima, H.,** *See* Sato, M., 6:34043
**Miyares, J.R.,** *See* Baram, M.S., 6:33770
**Mlekodaj, R.L.,** *See* Pegg, D.J., 6:33955
**Moaveni, M.,** Solving coal flow problems at Detroit Edison Company, 6:32929 (EPRI-WS—79-236, pp 2.103-2.121)
**Mock, W. Jr.,** *See* Singh, J.J., 6:33789
**Modera, M.P.,** *See* Blomsterberg, A.K., 6:33457
**Moerlein, S.M.,** Tricatecholamide analogs of enterobactin as gallium- and indium-binding radiopharmaceuticals, 6:33623
**Mohan, N.,** *See* Kappenman, J.G., 6:33279
**Moir, R.W.,** *See* Berwald, D.H., 6:34117
**Moll, S.,** *See* Pacer, J.C., 6:33001
**Moltz, D.M.,** *See* Toth, K.S., 6:34024
**Montanino, L.N.,** *See* Simpkin, A.J., 6:32812
**Montelone, B.A.,** Spontaneous mitotic recombination in mms8-1, an allele of the CDC9 gene of Saccharomyces cerevisiae, 6:33873
**Montenegro, E.C.,** *See* Paschoa, A.S., 6:33813
**Montgomery, D.B.,** Fueling and exhaust: an engineering view, 6:34079 (CONF-801011—(Vol.1), pp 67-80)
**Mooers, H.D.,** *See* Severson, L.S., 6:32896
**Moore, A.R.,** Amorphous boron-silicon-hydrogen alloys for thin-film heterojunction solar cells. Quarterly technical progress report No. 2, 1 September 1980-30 November 1980, 6:33117 (SERI/PR—0-9010-2)
Amorphous boron-silicon-hydrogen alloys for thin-film heterojunction solar cells. Quarterly technical progress report No. 3, 1 December 1980-28 February 1981, 6:33118 (SERI/PR—0-9010-3)
**Moore, B.,** Advanced isotope separation technology, 6:33612 (LBL—12000, pp 457-467)
**Moore, C.F.,** *See* Morris, C.L., 6:34005
**Moore, R.W.,** *See* Bernard, L.C., 6:34060
*See* Brown, D.P., 6:33679
*See* Chu, M.S., 6:34059
*See* Wu, K.C., 6:33681
**Moore, W.M.,** Tooling for electrochemical deburring. Topical report, 6:33629 (BDX—613-2644)
**Moorhead, A.J.,** Brazing of sensors for high-temperature steam instrumentation systems, 6:33363
**Morehouse, J.H.,** *See* White, N.M., 6:33186
**Morgan, C.S.,** *See* Moorhead, A.J., 6:33363
**Morgan, G.D.,** First-wall/blanket design for the STARFIRE tokamak reactor, 6:34143 (CONF-801011—(Vol.3), pp 674-683)
**Morgan, J.,** Evaluation of coal blending systems, 6:32933 (EPRI-WS—79-236, pp 6.1-6.24)
**Morgan, J.R.,** *See* Hecker, S.S., 6:33524
*See* Zukas, E.G., 6:33525
**Morgan, W.D.,** *See* Biggin, H.C., 6:33866
*See* Ellis, K.J., 6:33905
*See* Ettinger, K.V., 6:33868
**Mori, S.,** Fusion technology program in Japan, 6:34076 (CONF-801011—(Vol.1), pp 29-39)
**Mormile, D.J.,** *See* Piper, B.F., 6:32989
**Morris, C.L.,** Measurements of isospin mixing between the $1^+$ doublet in $^{12}C$ using pion inelastic scattering, 6:34005
**Morris, J.F.,** Program-management plan with critical-path definition for combustion augmentation with thermionic energy conversion (CATEC), 6:33438 (DOE/NASA/1062—9)
**Morris, J.W. Jr.,** High strength austenitic alloys for generator retaining rings, 6:33527 (LBL—12000, pp 513-514)
Magnetic fusion energy, 6:33526 (LBL—12000, pp 497-500)
**Morris, P.A.,** *See* Borison, A.B., 6:33424, 6:33425, 6:33426
**Morris, R.N.,** *See* Bateman, G., 6:34169
**Morse, W.,** *See* Leipuner, L.B., 6:33688
**Morse, W.M.,** Search for the violation of time-reversal invariance in K/sub $\mu$3/ decays, 6:33965 (BNL—30026)
**Mortimer, A.R.,** Review of the icing problem for aerogenerators, 6:33239
**Mortimer, R.K.,** *See* Schild, D., 6:33860
**Morton, R.A.,** Pleasant Bayou No. 2: a review of rationale, ongoing research and preliminary test results, 6:33214 (CONF-811026—8)
Salinity of deep formation waters, Texas Gulf Coast - preliminary results, 6:32991 (CONF-811026—6)
*See* Gregory, A.R., 6:32990
**Moses, D.,** Study description: an environmental comparison of future urban-transportation alternatives, 6:33395
**Moses, H.,** Impact of climate and energy, and the $CO_2$ problem, 6:33275
**Moses, R.W.,** *See* Nebel, R.A., 6:34054
**Mosher, B.W.,** *See* Zoller, W.H., 6:33728
**Moss, J.M.,** Intermediate energy proton and light-ion scattering, 6:33995 (LA-UR—81-2410)
**Moss, O.R.,** *See* DeFord, H.S., 6:33703
**Moyers, J.L.,** *See* Zoller, W.H., 6:33728
**Mueller, L.D.,** Fitness and density-dependent population growth in Drosophila melanogaster, 6:33862
**MuKamel, D.B.,** *See* Craig, P., 6:33399
**Mukunda, N.,** Dirac's new relativistic wave equation in interaction with an

electromagnetic field, 6:34049 (DOE/ER/03992—448)
**Mulac, A.J.,** *See* Fox, R.L., 6:32971
**Mullendore, A.W.,** *See* Whitley, J.B., 6:34134
**Muller, R.H.,** *See* Evans, J.W., 6:33378
**Mullins, R.A.,** Coal handling is more than material handling, 6:32931 (EPRI-WS—79-236, pp 4.1-4.13)
**Munoz-Cobos, J.G.,** PAPIN: A Fortran-IV program to calculate cross section probability tables, Bondarenko and transmission self-shielding factors for fertile isotopes in the unresolved resonance region, 6:34028 (ORNL/TM—7883)
**Munro, J.K. Jr.,** Comparison of results between the ballooning-modes codes BLOON and BALOON, 6:34063 (ORNL/CSD/TM—157)
**Munro, N.B.,** *See* Kimball, R.F., 6:33912
**Murphy, H.,** Relaxation of geothermal-reservoir stresses induced by heat production, 6:33229 (LA—8954-MS)
**Murphy, P.D.,** High-resolution $^{113}Cd$ NMR of solids. Correlation of spectra with the molecular structure of a decanuclear cadmium(II) complex, 6:33582
**Murray, D.P.,** *See* Skehan, J.W., 6:32899
**Musgrave, B.,** *See* Derrick, M., 6:33973
**Musinski, D.,** *See* Charatis, G., 6:34061
**Mustafa, M.G.,** *See* Hulet, E.K., 6:34030
**Myles, K.M.,** *See* Shearer, J.A., 6:32954
**Myra, J.R.,** Tandem transport and ambipolarity in the resonant plateau regime, 6:34070 (SAI—254-81-262-LJ)

## N

**Nadeau, C.E.,** Contracts or concessions for exploration and production, 6:33411 (EPRI-WS—79-182, pp 3.7.1-3.7.3)
**Nagamiya, S.,** What can we learn from inclusive spectra, 6:33969 (LBL—12950)
*See* Tanihata, I., 6:34008
**Nail, T.,** *See* Girshick, F., 6:34026
**Nakaishi, C.V.,** *See* Carpenter, L.K., 6:32952
**Nakamura, M.,** Apparatus for generating nonlinear pulse patterns, 6:33659
**Nakazawa, M.,** *See* Iguchi, T., 6:34090
*See* Tanaka, S., 6:34098
**Napier, A.,** *See* Lo, C.Y., 6:33988
**Narasimhan, T.N.,** Geothermal well testing, 6:33232
Multidimensional numerical simulation of fluid flow in fractured porous media, 6:33050 (LBL—11566, pp 16-32)
**Nathan, G.K.,** *See* Goh, T.N., 6:33244
**Nathan, O.,** *See* Christensen, P.R., 6:34016
**Naumann, R.A.,** *See* Girshick, F., 6:34026
**Nazaroff, W.W.,** Alpha-spectroscopic techniques for field measurement of radon daughters, 6:33766 (LBL—10769)
**Nebel, R.A.,** Ideal mhd stable startup and burn for the reversed field pinch, 6:34054 (CONF-801011—(Vol.3), pp 854-857)
**Neff, G.W.,** Holston-Pantex LX-17 formulation comparison, 6:33712 (MHSMP—81-38)
**Neff, T.L.,** Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**Neidlinger, H.H.,** *See* McCormick, C.L., 6:32968
**Nekoksa, G.,** *See* Hanck, J.A., 6:33280, 6:33281
**Nelson, D.B.,** *See* Uckan, N.A., 6:34065
**Nemtzow, D.,** *See* Counihan, R.H., 6:33396
**Nero, A.V.,** *See* Nazaroff, W.W., 6:33766
**Nessett, D.M.,** Identifier protection in a distributed operating system, 6:34203 (UCRL—86143)
Some notes on operating-system principles, 6:34196 (UCID—19076)
**Netherton, R.,** *See* Quong, R., 6:33223
**Netteshelm, P.,** *See* Steele, V.E., 6:33856
**Newman, J.,** *See* Evans, J.W., 6:33378
**Newman, M.J.,** One dimensional hydrodynamics of asteroid-neutron star collisions, 6:33948
**Newnam, B.E.,** *See* Warren, R.W., 6:33648
**Nguyen, V.V.,** *See* Mallett, C.W., 6:32914
**Nice, L.I.,** *See* McFadden, C.R., 6:32864
**Nicholson, R.D.,** Interfacial structures in nickel-based transition joints after long term service, 6:33266 (RD/M/N—1131)
**Nickell, R.E.,** Structural Mechanics Program: progress in 1980, 6:33289 (EPRI-NP—1969-SR)
**Nickels, J.S.,** *See* Bobbie, R.J., 6:33917
**Nickola, P.W.,** Studies at Plant Bowen: temperature/humidity plumes and condensate scavenging, 6:33759 (ORNL/TM—7744, pp 43-47)
**Nicoletti, N.,** Technical reports of the Federal Energy Administration. Cumulative through June 30, 1977, 6:33381 (NTISUB/C—221-404)
**Niece, J.E.,** Cost of ash disposal, 6:32877 (EPRI-WS—79-236, pp 20.1-20.17)
**Nietert, R.E.,** Experimental investigation of the convective heat transfer characteristics of particle-bed type fusion blankets, 6:34144 (CONF-801011—(Vol.3), pp 684-691)
**Nieves, A.L.,** *See* Nieves, L.A., 6:33460
**Nieves, L.A.,** Reclamation versus land use transformation: a cost comparison, 6:32885 (ANL/LRP-TM—20, pp 111-122)
Technology change and energy consumption: a comparison of residential subdivisions, 6:33460 (PNL-SA—9049)
**Ninomiya, K.,** *See* Kono, H.O., 6:32977
**Nishitani, T.,** *See* Iguchi, T., 6:34090
**Nitschke, J.M.,** Search for an 80 ms spontaneous fission activity in bombardments of $^{249}Bk$ with $^{15}N$, 6:34031
*See* Hulet, E.K., 6:34029
**Noble, J.P.,** Feasibility of electric vehicles in New Zealand, 6:33493
**Noorishad, J.,** Finite element method for coupled stress and fluid flow analysis of fractured rock masses, 6:33929 (LBL—11566, pp 43-49)
Program ROCMAS: introduction and user's guide, 6:33931 (LBL—12987)
**Norman, J.,** *See* Wong, C.P.C., 6:34146
**Norris, D.M.,** *See* Nickell, R.E., 6:33289
**Northcutt, W.G. Jr.,** *See* Vandermeer, R.A., 6:33534
**Noshkin, V.E.,** *See* Robison, W.L., 6:33829
**Nour, N.E.,** *See* Jensen, B.K., 6:34118
**Novakov, T.,** *See* Benner, W., 6:33748
*See* Brodzinsky, R., 6:33747
*See* Chang, S., 6:33750
*See* Clemenson, M., 6:33579
*See* Cohen, S., 6:33752
*See* Gomiscek, S., 6:33751
*See* Gundel, L., 6:33755, 6:33757
*See* Hansen, A., 6:33756
*See* Oblath, S., 6:33749
*See* Rosen, H., 6:33753
*See* Sadler, M., 6:33754
**Novick, A.S.,** Design and preliminary results of a fuel flexible industrial gas turbine combustor, 6:32950
**Novil, M.,** *See* Srivastava, V.J., 6:33084
**Nunz, G.J.,** Status report--hot dry rock geothermal energy, 6:33231
**Nurmia, M.J.,** *See* Nitschke, J.M., 6:34031
**Nutt, G.L.,** Computer modeling of piezoresistive gauges, 6:33702 (UCRL—85763-Rev.1)
**Nutt-Powell, T.E.,** Institutional analysis of solar heating and cooling of housing: summary report, 6:33101 (MIT-EL—79-044)
Institutional analysis of the solar heating and cooling residential demonstration program, 6:33182 (MIT-EL—80-024)
Photovoltaics and the national park service: an institutional analysis, 6:33102 (MIT-EL—80-007)
Research design for institutional analysis of HUD's solar heating and cooling demonstration program, 6:33099 (MIT-EL—79-029)
Solar heating and cooling of housing: five institutional analysis case studies, 6:33100 (MIT-EL—79-030)
Solar heating and cooling standard setting: an institutional analysis case study, 6:33181 (MIT-EL—79-045)
**Nye, R.A.,** *See* Lynch, F.E., 6:33631

## O

**O'Brien, R.E.,** Central station dust control for coal handling equipment, 6:32940 (EPRI-WS—79-236, pp 13.1-13.12)
**O'Connor, J.T.,** *See* Reach, C.D. Jr., 6:33785
**O'Grady, W.E.,** *See* Adzic, R.R., 6:33605
**O'Kay, N.,** *See* Bauke, W., 6:34177
**O'Kelley, G.D.,** Autoradiographic studies of actinide sorption in groundwater systems, 6:33824 (CONF-800433—, pp 540-548)
**O'Sullivan, J.B.,** Application of molten carbonate fuel cells to OTEC-generated fuels, 6:33443
**Oakes, T.W.,** *See* Ohnesorge, W.F., 6:33803
**Oblath, S.,** Aqueous reactions of nitrite and bisulfite, 6:33749 (LBL—11986, pp 5.7-5.10)
**Ochs, T.,** Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981, 6:33192 (DOE/CS/30174—T2Vol.1)
**Oertel, G.K.,** Low-level waste management, 6:33045
**Oesterreicher, H.,** Queries concerning local models for hydrogen uptake in metal hydrides, 6:33592

**Offermann, F.J.,** Midway house-tightening project: a study of indoor air quality, 6:33458 (LBL—12777)
**Ogawa, A.,** *See* Kennett, R.G., 6:33972
**Ogawa, S.Y.,** *See* Delgado, R. Jr., 6:33291
**Ogier, W.C.,** *See* McMillen, D.F., 6:32844
**Ogle, J.C.,** *See* Vandermeer, R.A., 6:33534
**Ohlsen, G.G.,** Description of polarization analyzing powers for three-body breakup reactions, 6:33998
**Ohnesorge, W.F.,** Environmental radiological survey of the intermediate-level waste system pipeline, 6:33803 (ORNL/TM—7858)
**Ohr, S.M.,** *See* Kobayashi, S., 6:33545
**Ohr, S.Y.,** *See* Begovich, C.L., 6:33889
**Ohyabu, N.,** Reactor aspects of expanded boundary approach, 6:34082 (CONF-801011—(Vol.1), pp 225-228)
**Okabayashi, M.,** *See* Yamazaki, K., 6:34069
**Okuda, S.,** Superconducting current densities in bronze-processed $Nb_3Sn$ multifilamentary wires, 6:33501 (BNL—30018)
*See* Suenaga, M., 6:33502
**Oldenborg, R.C.,** *See* Wampler, F.B., 6:33615
**Oldfather, J.,** *See* Harte, J., 6:33822
**Oldham, R.D.,** *See* Toohey, R.E., 6:33892
**Oliphant, T.A.,** *See* Brownell, J.H., 6:34062
**Olken, F.,** Efficient methods for calculating the success function of fixed-space replacement policies, 6:34193 (LBL—12370)
**Olness, D.U.,** LLNL underground coal gasification project. Quarterly progress report, January-March 1981, 6:32842 (UCRL—50026-81-1)
**Olson, A.J.,** Computer simulation of organic and biological molecules, 6:33846 (LBL—12979)
**Olson, D.B.,** Soot formation in synfuels. Second quarterly report, 1 January 1981-31 March 1981, 6:33083 (DOE/PC/30304—2)
**Olson, E.A.J.,** *See* Koppe, R.H., 6:33392
**Olson, J.H.,** *See* Short, D.R., 6:33617
**Olson, K.,** *See* Curtis, R., 6:33455
**Ondov, J.M.,** Elemental composition of atmospheric fine-particles emitted from coal burned in a modern electric power plant equipped with a flue-gas desulfurization system, 6:33762 (UCRL—85035)
**Onischak, M.,** *See* Knight, R.A., 6:32941
**Ono, F.,** *See* Tanaka, S., 6:34098
**Oppenheim, A.K.,** *See* Hurlbut, F.C., 6:33626
**Orrison, L.H.,** Characteristics of environmental isolates of Legionella pneumophila, 6:33876
**Osborne, L.S.,** Myocardial perfusion scintigraphy using a new technique, the mesh chamber. Progress report, September 1, 1978-May 1, 1981, 6:33689 (DOE/EV/04969—3)
**Osgood, C.J.,** *See* Boyd, J.B., 6:33861
**Osteryoung, R.A.,** *See* Chum, H.L., 6:33442
**Othman, I.,** Neutron activation analysis of hair from breast cancer patients, 6:33867 (CONF-800433—, pp 360-368)
**Otsuki, H.H.,** *See* Quong, R., 6:33223
**Otte, L.J.,** *See* Ingram, R.L., 6:32898
**Otto, N.C.,** *See* Barney, D.L., 6:33376
**Owen, G.N.,** Developing seismic design criteria, 6:33031 (DPST—81-262, pp 7p, Paper 6)
Earthquake engineering of large underground structures, 6:33033 (DPST—81-262, pp 9p, Paper 9)
**Owen, J.,** *See* Noble, J.P., 6:33493

## P

**Pacer, J.C.,** Geochemical exploration for uranium in the Red Desert, Wyoming, 6:33001 (GJBX—125(81))
**Packer, L.,** Membrane oxidative damage, 6:33854 (LBL—11986, pp 5.40-5.42)
**Paganessi, J.E.,** Hydrogasification PDU studies, 6:32846
Peat dewatering: solvent extraction, 6:32942
**Paglia, A.L.,** *See* Calloway, N.E., 6:33353
**Pagliano, G.J.,** Mexico's oil and gas: a realistic perspective, 6:33417 (EPRI-WS—79-182, pp 3.16.1-3.16.10)
**Pagliaro, P.,** *See* Stonehart, P., 6:33440
**Pahwa, S.B.,** Detection of fractures from well testing, 6:33930 (LBL—11566, pp 60-64)
**Paine, R.G. III.,** *See* Diaz-Tous, I.A., 6:32925
**Palmer, H.G.,** *See* Erickson, L.M., 6:33715
**Palmeri, A.,** *See* Rappe, G.H., 6:34158
**Palopoli, S.F.,** SRC-I Demonstration Plant analytical laboratory, 6:32829 (DOE/OR/03054—3, pp 151-224)
**Panayotatos, P.,** Use of V/sub OC//J/suc SC/ measurements for determination of barrier height under illumination and for fill-factor calculations in Schottky-barrier solar cells, 6:33565
**Panayotou, N.F.,** *See* Brager, H.R., 6:33515
**Panda, F.A.,** *See* Hoffmann, M.R., 6:33871
**Pande, C.S.,** Imaging of small distortions in A15 'lattice' by electron microscopy, 6:33528
**Pandharipande, V.R.,** *See* Wiringa, R.B., 6:34032
**Panos, C.N.,** *See* Bodmer, A.R., 6:34012
**Parees, D.M.,** *See* Kingsley, I.S., 6:32828
*See* Palopoli, S.F., 6:32829
**Parish, T.A.,** Fusion-fission combinations with DT and DD fuels, 6:34121 (CONF-801011—(Vol.2), pp 1526-1536)
*See* Davidson, J.W., 6:33067
**Parker, B.,** *See* Nutt-Powell, T.E., 6:33100
**Parker, J.T.,** Semiannual progress report for the Idaho Geothermal Program, October 1, 1980 to March 31, 1981, 6:33225 (EGG—2110)
**Parker, N.L.,** *See* Erickson, L.M., 6:33715
**Parkinson, T.F.,** *See* Skelly, J.M., 6:33907
**Parks, C.F.,** Chemical crusting of coal stockpiles for the control of fugitive dust, water erosion, water penetration and spontaneous firing, 6:32939 (EPRI-WS—79-236, pp 12.1-12.13)
**Parks, C.V.,** *See* Maudlin, P.J., 6:33312
**Parks, R.L.,** *See* Dennis, L.C., 6:34003
**Parsly, L.F.,** *See* Mitchell, H.A., 6:32841
**Parsons, D.W.,** *See* Ohnesorge, W.F., 6:33803
**Paschoa, A.S.,** Element analysis by PIXE of environmental samples of the Brazilian Cerrado, 6:33813 (CONF-800433—, pp 147-158)
**Passell, L.,** *See* Majkrzak, C.F., 6:34036
**Patmore, J.,** *See* Deligiannis, K.S., 6:33260
**Patrinos, A.A.N.,** Studies at Plant Bowen: rainfall modification and wetfall chemistry, 6:33722 (ORNL/TM—7744, pp 5-42)
*See* Hoffman, H.W., 6:33769
**Patterson, J.A.,** Fuel availability--uranium results of INFCE investigations, 6:33000
**Patzer, R.G.,** *See* Smith, D.D., 6:33802
**Paul, D.D.,** *See* Esser, P.D., 6:34140
**Paul, M.,** *See* McKeown, R.D., 6:34001
**Payne, R.,** *See* England, G., 6:33743
**Payne, S.F.,** Marine mammals of Hawaii: a bibliography, 6:33830 (LBL—13192)
Marine mammals of Puerto Rico: a bibliography, 6:33831 (LBL—13193)
**Pearson, C.,** *See* Albright, J., 6:32987
**Pearson, F.J. Jr.,** *See* Mercer, J.W., 6:33375
**Pearson, R.L.,** *See* Lindemer, T.B., 6:33507
**Peaslee, A.T. Jr.,** Some political issues related to future special nuclear materials production, 6:33061 (LA—8969-MS)
**Pecequilo, B.R.S.,** Prompt neutron capture gamma ray analysis of nuclear fuel materials with a pair spectrometer, 6:33788 (CONF-800433—, pp 247-257)
**Pechan, E.H.,** *See* Roth, H.D., 6:33910
**Pedersen, T.E.,** Automation of a specimen stage in an electron microprobe. Final report, 6:33696 (BDX—613-2668)
**Peercy, P.S.,** *See* Land, C.E., 6:33561
**Pegg, D.J.,** Radiative lifetime of the 6p $^4P°$/sub 5/2/ level in Xe II, 6:33955 (CONF-810868—1)
*See* Compton, R.N., 6:33961
**Pei, B.,** *See* Weisman, J., 6:33349
**Pekrul, P.J.,** Vibration signature analysis and acoustic-emmission monitoring at Brayton Point. Final report, 6:33262 (EPRI-CS—1938)
**Peltzman, E.,** *See* Davis, A., 6:33448
**Peng, J.C.,** Energy dependence of nucleus-nucleus total cross sections, 6:34006
**Penney, T.R.,** Overview and FY 1981 progress on open-cycle OTEC power systems, 6:33157 (SERI/TP—634-1282)
**Pennise, S.,** *See* Pekrul, P.J., 6:33262
**Pepelnik, R.,** *See* Fanger, H.U., 6:33730
**Pepper, W.B.,** Development of the ARIES parachute system, 6:33639 (SAND—81-0208C)
**Pereyra, R.A.,** *See* Hecker, S.S., 6:33524
*See* Zukas, E.G., 6:33525
**Perez-Blanco, H.,** Cycle and performance analysis of absorption heat pumps for waste heat utilization, 6:33471 (ORNL/TM—7852)
**Perkins, E.H.,** *See* Marusic, M., 6:33902
**Perkins, W.G.,** Deflagration-to-detonation transition (DDT) project. Semiannual report, June-November 1980, 6:33713 (SAND—81-0937)
**Perone, S.P.,** *See* Richardson, J.H., 6:33614
**Perrin, C.,** *See* Egger, J.P., 6:34014
**Perry, C.W.,** Economics of enhanced oil recovery and its position relative to synfuels, 6:32976
**Perry, E.,** *See* Rappe, G.H., 6:34158

**Perry, R.D.,** *See* Derby, G.K., 6:32892
**Perry, R.T.,** Review of neutronic design criteria, 6:34096 (CONF-801011—(Vol.1), pp 470-472)
*See* Leonard, B.R. Jr., 6:34095
**Person, W.B.,** *See* Kim, K.C., 6:33958
**Pessagno, S.,** *See* Krill, W.V., 6:32945
**Peters, R.,** *See* Fisk, H.E., 6:33674
**Peters, R.D.,** Fracturing of simulated high-level waste glass in canisters, 6:33041 (PNL—3948)
**Petersen, J.F.,** *See* Betts, R.R., 6:34011
**Peterson, A.C. Jr.,** *See* Hsu, M., 6:33341
**Peterson, D.T.,** *See* Powell, R.W., 6:33513
**Peterson, E.J.,** Investigations of Occidental Oil Shale, Inc., retort 3E spent shales, 6:32995 (LA—8792-MS)
**Peterson, G.A.,** Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)
**Peterson, P.J.,** *See* Valente, I.M., 6:33793
**Peterson, R.,** *See* Hurlbut, F.C., 6:33626
**Peterson, W.G.,** *See* Hasibar, R.M., 6:33283
**Petke, J.D.,** Stereoelectronic properties of photosynthetic and related systems. 10. Quantum mechanical characterization of the excited states of ethyl chlorophyllide $\alpha$ enol, 6:33609
**Pettitt, R.A.,** *See* Mathews, M., 6:33218
**Pettus, W.G.,** Characteristics of a spectral-shift blanket for hybrid reactor application, 6:34122 (CONF-801011—(Vol.2), pp 1537-1554)
Conceptual fusion power monitor based on the $^{16}O(n,p)^{16}N$ reaction, 6:34108 (CONF-801011—(Vol.2), pp 1342-1357)
*See* Caldwell, C.S., 6:34133
**Pew, R.W.,** Evaluation of proposed control room improvements through analysis of critical operator decisions. Final report, 6:33333 (EPRI-NP—1982)
**Pfeffer, J.,** *See* Isaacson, R., 6:33079
**Phelts, E.,** *See* Clark, J., 6:33255, 6:33256
**Phetteplace, G.,** *See* Lunardini, V.J., 6:33404
**Philipp, W.H.,** New ion exchange membranes, 6:33616 (NASA-TM—81670)
**Phillips, G.E.,** *See* Lerche, R.A., 6:34185
**Phillips, N.E.,** Materials chemistry, 6:34045 (LBL—12000, pp 183-225)
**Phillips, W.A.,** *See* Robison, W.L., 6:33829
**Piascik, T.M.,** *See* Jensen, B.K., 6:34118
**Piatt, T.D.,** *See* Calloway, N.E., 6:33353
**Pickrell, J.A.,** *See* Griffis, L.C., 6:33914
**Pierantozzi, R.,** *See* Brockington, J.W., 6:32831
**Pierce, B.,** Process models for industry, 6:33464 (BNL—29880)
**Pierre, D.A.,** *See* Goldsworthy, D.L., 6:33268
**Piffaretti, J.,** *See* Morris, C.L., 6:34005
**Pillay, K.K.S.,** *See* Vance, E.R., 6:33022
**Pimpl, M.,** Plutonium as a tracer for studies of settling processes in a slow body of running water, 6:33826 (CONF-800433—, pp 719-728)
**Piper, B.F.,** Particulate emission characteristics of oil-fired urtility boilers, 6:32989 (EPRI-CS—1995)
**Pipis, J.S.,** Estimating the equivalent availability of a coal handling system, 6:32930 (EPRI-WS—79-236, pp 3.1-3.26)
**Pirbazari, M.,** *See* Suidan, M.T., 6:32867
**Pisula, R.,** *See* Dybeck, R., 6:33264
**Pitzer, K.S.,** Thermodynamics of electrolytes. IV. Activity and osmotic coefficients for mixed electrolytes, 6:33602
**Piulle, W.,** Survey of fly ash handling and removal systems; past, present and future practices and their effect on precipitator and baghouse reliability, 6:32871 (EPRI-WS—79-236, pp 14.1-14.36)
**Place, W.,** *See* Sullivan, P.W., 6:33173
**Plasil, F.,** Angular momentum effects in fusion-fission and fusion-evaporation reactions, 6:34035
**Platt, H.D.,** Regional load-curve models: scenario and forecast using the DRI model. Final report, 6:33422 (EPRI-EA—1672(Vol.3))
**Plumb, O.A.,** *See* Huenefeld, J.C., 6:33963
**Plumley, A.L.,** Cofiring of refuse-derived fuel and coal at Oak Creek. Volume 1. Boiler corrosion evaluation. Final report, 6:33088 (EPRI-CS—1983-Vol.1)
**Pocanic, D.,** *See* Drake, D.M., 6:34007
**Poenaru, V.,** *See* Chew, G.F., 6:33982
**Porten, D.R.,** *See* Ferrell, P.C., 6:33355
**Posey, J.S.,** *See* Gregory, A.R., 6:32990
*See* Morton, R.A., 6:32991
**Post, D.E.,** Techniques for measuring the alpha-particle distribution in magnetically confined plasmas, 6:34074
**Poutsma, M.L.,** Thermolysis of naphthols, 6:32808 (CONF-810914—6)
**Powe, R.E.,** *See* Kumar, R.A., 6:33436
**Powell, E.K.,** Rate and activation enthalpy of decomposition of $CaCO_3$, 6:33595
**Powell, J.R.,** *See* Horn, F.L., 6:33498
*See* Steinberg, M., 6:33318
**Powell, R.W.,** Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
**Prakash, L.,** *See* Montelone, B.A., 6:33873
**Prakash, S.,** *See* Montelone, B.A., 6:33873
**Prater, L.S.,** Bibliography of the seasonal thermal energy storage library, 6:33374 (PNL—3645)
**Pratt, H.R.,** Earthquake damage to underground facilities, 6:33924 (DPST—81-262, pp 6p, Paper 1)
**Pratt, R.H.,** *See* Kissel, L., 6:33959
**Precious, R.W.,** Summary report of the ABMA test program to update emissions and efficiency performance of industrial stoker-fired boilers, 6:33274
**Preedom, B.M.,** *See* Egger, J.P., 6:34014
**Preto, S.K.,** *See* Barney, D.L., 6:33376
**Pripstein, M.,** *See* Kennett, R.G., 6:33972
*See* Smits, R.G., 6:33637
**Pritchett, J.W.,** Geothermal reservoir simulation capabilities at Systems, Science, and Software, 6:33213 (LBL—11566, pp 90-98)
**Pritz, P.M.,** *See* Butz, T.R., 6:33006
**Pruess, K.,** SHAFT79, 6:33211 (LBL—11566, pp 99-101)
**Pruett, D.J.,** Solvent extraction behavior of ruthenium I. The nitric acid-tri-n-butyl phosphate system, 6:33586
**Pugh, T.,** *See* Turner, W.D., 6:33124
**Puhn, F.A.,** OHTE confinement test, an engineering overview, 6:34150 (CONF-801011—(Vol.3), pp 871-884)
**Puigh, R.J.,** Miniaturized fatigue crack growth specimen technology and results, 6:33517 (HEDL-SA—2475)
**Punwani, D.V.,** *See* Paganessi, J.E., 6:32846
*See* Pyrcioch, E.J., 6:32845
**Pyrcioch, E.J.,** Single-stage fluidized-bed gasification, 6:32845
**Pywell, R.E.,** Measurement of the $^{18}O$ photonuclear cross sections as a test of a bremsstrahlung unfolding technique, 6:34002

## Q

**Quay, R.,** *See* Ferrante, J.J., 6:34086
**Quintanilha, A.,** *See* Packer, L., 6:33854
**Quong, R.,** High-pressure solvent extraction of methane from geopressured fluids, 6:33223 (UCRL—86515)

## R

**Raben, J.D.,** *See* Skehan, J.W., 6:32899
**Rabinovich, M.S.,** *See* Johnson, J.L., 6:34182
**Radin, A.,** New perspectives on public power, 6:33428
**Radke, L.F.,** *See* Hegg, D.A., 6:33744
**Rafn, E.F.,** Reconnaissance peatland surveys, 6:32902 (DOE/ET/14692—T1)
**Ragan, C.E.,** Shock-compression measurements at pressures greater than 1 TPa, 6:33521 (LA-UR—81-2426)
**Raghavan, N.V.,** Transient phenomena in the pulse radiolysis of retinyl polyenes. 1. Radical anions, 6:33618
**Raines, W.L.,** Determination of $^{210}Pb$ and $^{210}Po$ in the environment, 6:33799 (CONF-800433—, pp 560-569)
**Raith, B.,** *See* Wilde, H.R., 6:33734
**Raja, R.,** *See* Fisk, H.E., 6:33674
**Raker, M.L.,** *See* Hazen, T.C., 6:33877
**Ramanathan, R.,** Regional load-curve models: QUERI's model specification, estimation and validation. Final report, 6:33421 (EPRI-EA—1672(Vol.2))
**Ramani, R.V.,** *See* Sweigard, R.J., 6:32887
**Rambaek, J.P.,** Atmospheric deposition of heavy metals studied by analysis of moss samples using neutron activation analysis and atomic absorption spectrometry, 6:33729 (CONF-800433—, pp 175-180)
**Ramey, G.E.,** Conductor fatigue-life research. Final report, 6:33278 (EPRI-EL—1946)
**Ramey, H.J. Jr.,** *See* Gobran, B.D., 6:32986
**Ramsdell, J.V.,** Wind speed simulation for economic evaluation of wind energy conversion systems, 6:33234 (PNL-SA—9149)
**Ran, G.,** *See* Hou, X., 6:33662

**Ranadive, A.Y.,** *See* Andersson, C.A., 6:33547
**Randkiev, E.H.,** *See* Hinman, C.A., 6:33356
**Randle, J.B.,** *See* Noble, J.P., 6:33493
**Randolph, R.H.,** Performance bonding impact upon the cost of reclamation of coal mines lands, 6:32956 (ANL/LRP-TM—20, pp 67-74)
**Rao, M.A.,** Handbook for energy conservation in food canning plants, 6:33465 (DOE/CS/40087—T1)
**Rapaport, J.,** *See* Horen, D.J., 6:34020
**Rappe, G.H.,** Shielding for TFTR, 6:34158 (CONF-801011—(Vol.3), pp 985-995)
**Ratigan, J.L.,** *See* Burgess, A.S., 6:33928
**Raymond, K.N.,** *See* Edelstein, N.M., 6:33620
*See* Moerlein, S.M., 6:33623
**Reach, C.D. Jr.,** Neutron activation for the determination of total halogenated organics, 6:33785 (CONF-800433—, pp 127-134)
**Reading, J.F.,** One and a half centered expansion for ion-atom collisions, 6:33954 (CONF-800859—8)
**Reamer, A.,** *See* Nutt-Powell, T.E., 6:33100
**Rebagay, T.V.,** *See* Hofstetter, K.J., 6:33800
**Reber, E.E.,** Evaluation of active and passive near-millimeter-wave radiometric imaging techniques for detection of concealed objects, 6:33062 (SAND—81-1051)
**Reber, R.A.,** *See* VanDevender, J.P., 6:33658
**Reddy, H.K.,** *See* Morris, J.F., 6:33438
**Redekopp, R.D.,** Startup of the FFTF sodium cooled reactor, 6:33310 (HEDL-SA—2371)
**Redwine, R.P.,** *See* McKeown, R.D., 6:34001
**Reed, C.W.,** Partial discharge inception and extinction studies in polymer film structures impregnated with compressed $SF_6$ gas, 6:33276 (CONF-811016—2)
**Reed, R.W.,** *See* Moorhead, A.J., 6:33363
**Reed, T.B.,** Thermal and electrochemical biomass conversion at SERI, 6:33121 (SERI/TP—622-1174)
**Rees, J.,** *See* Harte, J., 6:33821, 6:33911
**Reich, C.,** *See* Maestre, M.F., 6:33599
**Reid, M.A.,** Preparation and characterization of electrodes for the NASA Redox storage system, 6:33441 (DOE/NASA/12726—13)
**Reilly, M.J.,** *See* Brinkman, D.W., 6:32807
**Reilly, T.A.,** *See* Gray, L.W., 6:33572
**Reineking, W.H.,** *See* Adamson, M.G., 6:33308
**Reinhardt, T.F.,** *See* Simpkin, A.J., 6:32812
**Reisfeld, M.J.,** *See* Kim, K.C., 6:33958
**Remboutsikas, D.,** *See* Galanis, N., 6:33251
**Reupke, W.A.,** Comparison of wetted-wall and magnetically protected-wall inertial fusion hybrid concepts, 6:34123 (CONF-801011—(Vol.2), pp 1555-1568)
**Reuther, P.C. Jr.,** *See* Scott, J.L., 6:34126
**Revell, P.S.,** Wind tunnel tests of sailwings for Darrieus rotors, 6:33245
**Revzan, K.L.,** *See* Nazaroff, W.W., 6:33766
**Rewoldt, G.,** Electromagnetic kinetic toroidal eigenmodes for general MHD equilibria, 6:34068 (PPPL—1830)
**Reynard, J.H.,** Ash disposal methods: Eastern and Western coal, 6:32876 (EPRI-WS—79-236, pp 19.1-19.10)
**Reynolds, R.J.,** Molecular mechanisms of pyrimidine dimer excision in Saccharomyces cerevisiae: excision of dimers in cell extracts, 6:33901
**Rheingrover, S.W.,** Identifying locations of dominant point sources of elements in urban atmospheres from large, multielement data sets, 6:33727 (CONF-800433—, pp 82-95)
**Ribble, G.H. Jr.,** *See* Horvath, D., 6:33487
**Ribe, F.L.,** Production of substitute natural gas by a fusion hybrid reactor coupled to a catalyzed coal gasification plant, 6:34125 (CONF-801011—(Vol.2), pp 1614-1621)
**Ricci, E.,** Gamma-ray spectrometric determination of $UF_6$ assay with 1 percent precision for international safeguards. Part 1. Product and feed in 1S and 2S sample cylinders, 6:33576 (K/OA—5014-Rev.1)
**Rice, W.W.,** *See* Wampler, F.B., 6:33615
**Richards, R.R.,** Ammonium iodide-potassium iodide mixed crystals in equilibrium with aqueous and aqueous-2-propanol solutions, 6:33596
**Richardson, J.H.,** Laser-induced photoelectrochemistry: scavenging of photoemitted electrons in aqueous and non-aqueous solutions by electroactive organic species, 6:33614
Two-laser induced selective infrared-visible fluorescence for thin film analysis, 6:33584
**Richter, B.,** *See* Chao, A.W., 6:33666
**Riedinger, L.L.,** *See* Braga, R.A., 6:34027
**Riley, D.R.,** Contribution of Clinch River Breeder Reactor plant design and development to the LMFBR fuel cycle, 6:33302 (CONF-810941—1)
**Riley, T.J.,** *See* Kolecki, J.C., 6:33134
**Ring, D.S.,** *See* Hackley, D.S., 6:34087
**Ripps, A.E.,** *See* Roth, H.D., 6:33910
**Ritchie, P.D.,** *See* Noble, J.P., 6:33493
**Rixon, L.K.,** *See* Enever, J.R., 6:32918
**Roberto, J.B.,** *See* Alton, G.D., 6:33668
**Roberts, J.G.,** Evaluation of the diagnostic sensitivity of scattering measurements of bone density, 6:33869 (CONF-800433—, pp 409-414)
**Robinson, J.J.,** *See* Toohey, R.E., 6:33892
**Robinson, P.D.,** Dose/response relationships and policy formulation, 6:34042 (PNL-SA—9317)
**Robison, W.L.,** Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)
**Roche, M.F.,** *See* Barney, D.L., 6:33376
**Roche, T.K.,** *See* Maziasz, P.J., 6:33505
**Roczniak, W.R.,** *See* Plumley, A.L., 6:33088
**Rodden, R.M.,** Cogeneration potential: enhanced oil recovery. Final report, 6:32970 (EPRI-EM—1996)
**Roddy, J.W.,** Distribution of ethanol-water mixtures to organic liquids, 6:33087
**Rode, C.,** *See* Koepke, K., 6:33676
**Rodman, C.W.,** Measurement of outdoor noise levels adjacent to K-25 facility, ORGDP, 6:33046 (K/SUB—13876-81/1)
**Rodriquez-Penz, A.,** *See* Cheng, T.C., 6:33282
**Roelke, R.J.,** Cold-air performance of compressor-drive turbine of Department of Energy upgraded automobile gas turbine engine. I. Volute-manifold and stator performance, 6:33486 (DOE/NASA/1011—34)
**Rogers, E.J.,** Impedance characteristics of large tower footings to a 100μs wide square wave of current, 6:33285
**Rogoff, P.,** *See* Zatz, I.J., 6:34135
**Rohwein, G.J.,** High-voltage air-core pulse transformers, 6:33657 (SAND—80-0451)
**Roland, H.C.,** *See* Roth, J.R., 6:34187
**Romero, J.,** *See* Salazar, J., 6:33962
**Root, D.H.,** *See* Attanasi, E.D., 6:33414
**Roscoe, B.A.,** Determination of mineral matter in coal by target transformation factor analysis, 6:33783 (CONF-800433—, pp 692-704)
**Rose, L.A.,** *See* Pipis, J.S., 6:32930
**Rose, P.H.,** *See* Willenberg, H.J., 6:34152
**Rose, R.P.,** Fusion hybrid parametric studies to assess potential utility applications, 6:34114 (CONF-801011—(Vol.2), pp 1423-1433)
**Rosen, H.,** Soot in the Arctic, 6:33753 (LBL—11986, pp 5.19-5.22)
*See* Gundel, L., 6:33757
*See* Sadler, M., 6:33754
**Rosenberg, N.I.,** Reducing the frozen coal problem to manageable proportions, 6:32938 (EPRI-WS—79-236, pp 11.1-11.11)
**Rosenfeld, A.,** Building energy data compilation, analysis, and demonstration, 6:33456 (LBL—11985, pp 4.50-4.61)
*See* Curtis, R., 6:33455
**Rosenwasser, S.N.,** *See* Scott, J.L., 6:34126
**Ross, D.S.,** *See* McMillen, D.F., 6:32844
**Ross, D.W.,** Kinetic theory of Alfven wave heating, 6:34057 (DOE/ET/53036—25)
**Ross, L.E.,** *See* Barney, D.L., 6:33376
**Ross, P.N.,** Fossil energy, 6:32862 (LBL—12000, pp 413-454)
*See* Evans, J.W., 6:33378
**Ross, R.R.,** *See* Smits, R.G., 6:33637
**Rossow, E.C.,** *See* Bazant, Z.P., 6:33556
**Rostoker, H.,** *See* Le, T., 6:32865
**Roth, H.D.,** Evaluation of CHESS: New York asthma data 1971 to 1972. Volume 2, 6:33910 (EPRI-EA—1994(Vol.2))
**Roth, J.R.,** Effect of wall loading limitations and choice of beta on the feasibility of advanced fuel fusion reactors, 6:34187
Electric field bumpy torus plasma as a test bed for plasma-wall interaction studies, 6:34145 (CONF-801011—(Vol.3), pp 692-701)
**Rothfuss, E.H. Jr.,** *See* Hayward, J.C., 6:32870
**Rowe, D.S.,** Design considerations for a high temperature $Li_2O$ flowing particulate blanket, 6:34139 (CONF-801011—(Vol.3), pp 595-617)
*See* Ribe, F.L., 6:34125

**Rowsome, R.J.,** Control of the fugitive dust during the loading of trucks with western coal fly ash, 6:32894 (EPRI-WS—79-236, pp 21.1-21.13)
**Roy, G.D.,** On heat balance in coal-fired MHD systems, channel heat transfer and electrode temperature distribution, 6:33437
**Rozsa, R.B.,** *See* Candy, J.V., 6:33058
**Ruane, M.,** Design and implementation of a demonstration supplementary control system, 6:33271 (MIT-EL—80-033)
**Ruberto, R.G.,** *See* Cronauer, D.C., 6:32834
**Rubin, M.,** *See* Selkowitz, S., 6:33453
**Rubinstein, F.,** *See* Berman, S., 6:33454
**Rudberg, D.A.,** *See* Goldsworthy, D.L., 6:33268
**Rudd, D.F.,** *See* Trevino, A.A., 6:32979
**Rudolf, T.,** *See* Leipuner, L.B., 6:33688
**Rudy, J.,** *See* Curtis, R., 6:33455
**Ruester, D.E.,** Thermal and structural analyses of a long pulse multiaperture grid for a neutral beam injector, 6:34083 (CONF-801011—(Vol.1), pp 229-236)
**Runchal, A.K.,** Porous media fluid flow, heat, and mass transport model with rock stress coupling, 6:33052 (LBL—11566, pp 50-59)
**Rundo, J.,** *See* Toohey, R.E., 6:33892
**Ruppel, H.M.,** *See* Harlow, F.H., 6:33360
**Russell, P.L.,** Evaluation of concepts for controlling exhaust emissions from minimally processed petroleum and synthetic fuels, 6:32953
**Russo, G.,** Solar energy conversion systems engineering and economic analysis. Volume I, 6:33094 (MIT-EL—79-032-Vol.1)
Solar energy conversion systems engineering and economics analysis. Input definition. Volume II, 6:33095 (MIT-EL—79-033-Vol.2)
**Rutter, W.,** Comparative economic performance of selected passive solar heating and cooling technologies, 6:33159 (BNL—51394)
**Ryavec, M.,** *See* Bird, N., 6:32980
**Ryder, J.F.,** *See* Hill, M.W., 6:33775

## S

**Saarivirta, J.,** *See* Koepke, K., 6:33676
**Sabatini, R.,** *See* Suenaga, M., 6:33502
**Sacher, G.A.,** Mammalian life histories: their evolution and molecular-genetic mechanisms, 6:33881
**Sadler, M.,** Intercomparison of the integrating plate and the laser transmission methods for determination of aerosol absorption coefficients, 6:33754 (LBL—11986, pp 5.23-5.25)
**Saegebarth, E.,** *See* Harte, J., 6:33821, 6:33911
**Sah, C.T.,** Effect of zinc impurity on silicon solar-cell efficiency, 6:33123
**Sah, R.L.Y.,** *See* Sah, C.T., 6:33123
**Sailor, V.L.,** Application of an LP model to strategic planning of multinational cooperative RD and D programs, 6:33387 (BNL—29857)
**Salazar, J.,** Bibliography Group T-3, 1955-1980, 6:33962 (LALP—81-29)
**Salghetti, F.,** *See* Ganzerli Valentini, M.T., 6:33812
**Samara, G.A.,** Recent advances in the study of structural phase transitions at high pressure, 6:34046 (SAND—81-1151C)
**Sanders, G.,** *See* Yokell, M.D., 6:32881
**Sanders, S.J.,** *See* McKeown, R.D., 6:34001
**Sanderson, W.G.,** Magma cooling-tower process pilot-plant demonstration. Final report, 6:33261 (EPRI-CS—1838)
**Sands, M.D.,** Ocean thermal energy conversion programmatic environmental analysis, 6:33152 (LBL—10511-Vol.1)
**Sandusky, W.F.,** Analysis of data from the US Department of Energy's meteorological validation program, 6:33243 (PNL-SA—9411)
**Santoro, G.J.,** *See* Lowell, C.E., 6:33509
**Sargent, G.A.,** Coal handling in freezing weather present state-of-the-art and research needs, 6:32936 (EPRI-WS—79-236, pp 9.1-9.36)
**Sarkinen, S.H.,** *See* Chartier, V.L., 6:33286
**Sasmor, D.J.,** *See* Schmidt, T.R., 6:33338
**Satchler, G.R.,** *See* Brink, D.M., 6:34033
*See* Fulmer, C.B., 6:34013
**Sato, M.,** Soft phonons and magnetic ordering in the γ-phase transition metal alloys Fe/sub 1-x/Pd/sub x/, 6:34043 (BNL—30037)
**Saunders, J.,** *See* Wegrzyn, J., 6:32805, 6:32806
**Saunders, S.,** Status of solar energy research and development in Australia, 6:33090 (NP—1903916)
**Saxena, A.M.,** *See* Majkrzak, C.F., 6:34036
**Saxman, A.C.,** *See* Bauke, W., 6:34177
**Saylor, R.E.,** *See* Patrinos, A.A.N., 6:33722
**Sayre, J.A.,** *See* Creed, K.E., 6:33069
**Scaiano, J.C.,** *See* Das, P.K., 6:33613
**Schaffhauser, A.C.,** *See* Inouye, H., 6:33536
**Schaich, K.M.,** *See* Borg, D.C., 6:33852
**Schaller, D.A.,** *See* Case, C.W., 6:33389
**Schapiro, N.,** *See* Skehan, J.W., 6:32899
**Scharre, D.L.,** Quarkonium spectroscopy, 6:33970 (SLAC-PUB—2761)
**Schearer, L.D.,** *See* McFarland, R.H., 6:33791
**Schellenbaum, R.L.,** *See* Reber, E.E., 6:33062
**Schiffer, J.P.,** *See* McKeown, R.D., 6:34001
**Schild, D.,** Endomitotic effect of a cell cycle mutation of Saccharomyces cerevisiae, 6:33860
**Schlachter, A.S.,** Production and destruction of $D^-$ by charge transfer in metal vapors, 6:34180 (LBL—12995)
**Schlafke, A.P.,** *See* Brown, D.P., 6:33679, 6:33684
**Schlatter, E.C.,** *See* Begovich, C.L., 6:33889
**Schlosberg, J.A.,** *See* Christiansen, J.H., 6:32825
*See* Wilks, W.H., 6:32826
**Schlyer, D.J.,** Study of coal oxidation by charged particle activation analysis, 6:33779 (CONF-800433—, pp 612-620)
**Schmidt, M.,** *See* Leipuner, L.B., 6:33688
**Schmidt, M.P.,** *See* Morse, W.M., 6:33965
**Schmidt, T.R.,** Design and fabrication of the instrumented fuel elements for the Annular Core Research Reactor (ACRR), 6:33338 (SAND—80-2365)
**Schmitt, B.F.,** Multielement analysis of soil of a sewage-farm by photon and neutron activation analysis using waste incineration ash as reference material, 6:33786 (CONF-800433—, pp 159-168)
**Schmittroth, F.,** *See* Mann, F.M., 6:34173
**Schneider, H.,** Analysis of the dynamic behavior of the electric arc for fusion magnet safety, 6:34088 (CONF-801011—(Vol.1), pp 329-334)
**Schneider, J.W.,** Stress relaxation of cellular silicone material: 1981, 6:33555 (BDX—613-2645)
**Schneider, R.,** *See* Harte, J., 6:33822
**Schneider, R.A.,** Development of automated welding process for field fabrication of thick walled pressure vessels, 6:33324 (DOE/ET/13511—T8)
**Schneider. W.J.,** Transient response of a thermal buffer: a study for ISABELLE, 6:33680 (BNL—30008)
*See* Bamberger, J.A., 6:33683
*See* Brown, D.P., 6:33684
*See* Werner, A.P., 6:33682
**Schnetzer, S.,** *See* Tanihata, I., 6:34008
**Schombert, J.M.,** *See* Tohline, J.E., 6:33945
**Schoor, A.,** *See* Hakki, A., 6:33423
**Schreiber, J.D.,** Parametric study of the cadmium thermoelectrochemical hydrogen cycle, 6:33078 (CONF-810812—38)
**Schreiner, F.,** *See* Richards, R.R., 6:33596
**Schreiner, P.,** *See* Derrick, M., 6:33973
**Schreiner, R.,** *See* Karas, B.R., 6:33105
**Schuettelkopf, H.,** *See* Pimpl, M., 6:33826
**Schuller, I.K.,** Coherent multilayer crystals and method of making, 6:33566
**Schultz, D.,** *See* Russell, P.L., 6:32953
**Schultz, J.H.,** Novel limiter pump topologies, 6:34171 (DOE/ET/51013—6)
**Schultz, K.R.,** *See* Cheng, E.T., 6:33064
*See* Wong, C.P.C., 6:34146
**Schwarz, E.,** *See* Egger, J.P., 6:34014
**Schweighardt, F.K.,** *See* Kingsley, I.S., 6:32828
**Schwenke, H.,** Ultra-sensitive trace element analysis of environmental samples using advanced TRXRF techniques, 6:33815 (CONF-800433—, pp 313-320)
**Schwenterly, S.W.,** Cryogenic pressure testing of demountable seals for large-coil program applications, 6:33633 (CONF-810835—12)
**Schweppe, F.,** *See* Ruane, M., 6:33271
**Scott, J.L.,** Progress in the development of the blanket structural material for fusion reactors, 6:34126 (CONF-801011—(Vol.2), pp 1661-1672)
**Scott, M.D.,** Northern Great Plains reclamation cost projections by computer, 6:32889 (ANL/LRP-TM—20, pp 191-202)
**Scudiere, J.D.,** *See* Hackley, D.S., 6:34087
**Seaborg, G.T.,** *See* Edelstein, N.M., 6:33620
**Searcy, A.W.,** *See* Meschi, D.J., 6:33604

*See* Powell, E.K., 6:33595
**Sederquist, R.A.,** *See* Russell, P.L., 6:32953
**Sedlet, J.,** *See* Toohey, R.E., 6:33892
**Seeley, F.G.,** *See* Mcdowell, W.J., 6:32868
**Seeman, S.E.,** *See* Henderson, J.M., 6:33357
**Seery, B.D.,** *See* Viswanathan, V.K., 6:34176
**Seestrom-Morris, S.J.,** *See* Morris, C.L., 6:34005
**Seetoo, W.R.,** Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**Segebade, C.,** *See* Schmitt, B.F., 6:33786
**Segel, R.E.,** *See* McKeown, R.D., 6:34001
**Seidman, D.N.,** *See* Amano, J., 6:33956
**Sekiguchi, A.,** *See* Iguchi, T., 6:34090
**Selan, J.C.,** Technical evaluation of the noise and isolation testing of the safety features actuation system at the Davis Besse Nuclear Power Station, Unit 1, 6:33298 (UCID—19104)
Technical evaluation of the station and instrument ground grid systems at the Davis Besse Nuclear Power Station, Unit 1, 6:33299 (UCID—19105)
**Selkowitz, S.,** Energy-efficient windows program, 6:33453 (LBL—11985, pp 4.31-4.40)
*See* Berman, S., 6:33454
**Selvidge, J.,** Probabilities of aircraft crashes at Rocky Flats and subsequent radioactive releases, 6:33768 (RFP—2462-Add.)
**Serne, R.J.,** *See* Gore, B.F., 6:33056
**Seth, O.W.,** *See* Dalder, E.N.C., 6:33640
**Setlow, J.K.,** Transformation of Haemophilus influenzae by recombinant molecules, 6:33858 (BNL—29733)
**Sever, L.E.,** Epidemiological approaches to reproductive hazards of the workplace, 6:33913 (PNL-SA—9435)
**Severson, L.S.,** Inventory of peat resources, Koochiching County, Minnesota, 6:32896 (DOE/ET/14692—T2App.A-D)
**Sevier, D.L.,** Performance of TiC-coated graphite in electron-beam tests and Doublet III operation, 6:34172 (GA-A—16384)
**Sha, J.Y.,** *See* Toohey, R.E., 6:33892
**Shah, P.K.,** Neutron activation analysis of copper and silver in environmental samples, 6:33736 (CONF-800433—, pp 437-441)
*See* Ganesan, R., 6:33814
**Shah, Y.T.,** *See* Slagle, D., 6:32838
**Shaikh, A.M.,** Impact of economic and demographic growth on oil and gas availability from less developed countries, 6:33408 (EPRI-WS—79-182, pp 3.4.1-3.4.18)
**Shain, W.A.,** Growth and yield of loblolly, slash, and longleaf pines in the South Carolina Sandhills: third measurement. Final report, 6:33886 (DOE/SR/10706—1)
**Shakiba, H.,** *See* Aframian, A., 6:33884
**Shapira, D.,** *See* Dennis, L.C., 6:34003
**Shapiro, S.M.,** *See* Sato, M., 6:34043
**Sharp, R.R. Jr.,** One hundred prime references on hydrogeochemical and stream sediment surveying for uranium as internationally practiced, including 60 annotated references, 6:33013 (LA—6647-MS)
**Sharpe, R.,** *See* Kamil, H., 6:33032
**Shaw, H.,** *See* Cain, W.C., 6:32895
**Shaw, K.E.S.,** *See* Boyd, J.B., 6:33861
**Shearer, J.A.,** Hydration enhanced sulfation of limestone and dolomite in the fluidized-bed combustion of coal, 6:32954
**Sheff, J.R.,** Potential for lessened waste hazards from the thorium cycle by means of fusion symbiosis, 6:33066 (CONF-801011—(Vol.2), pp 1306-1315)
**Sheldon, D.B.,** Edge stresses in spherical-shell solar receivers, 6:33193 (DOE/ET/21015—11)
**Shell, P.,** Use of alkali metal-acid phosphates for elevated temperature water electrolysis, 6:33077 (UCRL—86623)
**Shell, P.K.,** *See* Krikorian, O.H., 6:33076
**Shelpuk, B.,** *See* Penney, T.R., 6:33157
**Shelton, E.M.,** Heating oils, 1981, 6:32985 (DOE/BETC/PPS—81/4)
Motor gasolines, Winter 1980-81, 6:32988 (DOE/BETC/PPS—81/3)
**Shenton, L.R.,** Problems associated with approximating distributions, 6:34199
*See* Bowman, K.O., 6:34194
**Shepard, N.F. Jr.,** Integrated residential photovoltaic array development. Quarterly report No. 2, 6:33125 (DOE/JPL/955894—2)
**Shepherd, J.,** *See* Enever, J., 6:32922
*See* Enever, J.R., 6:32858, 6:32918
**Shi, J.,** *See* Zhu, Y., 6:32974
**Shih, C.F.,** *See* Kumar, V., 6:33510
**Shin, Y.W.,** Hybrid numerical method for homogeneous equilibrium two-phase flows in one space dimension, 6:33296
**Shinn, W.,** *See* Bates, J., 6:33540
**Shipman, L.L.,** *See* Petke, J.D., 6:33609
**Shizuya, K.,** Soft-gluon effects in nonleptonic decays of charmed mesons, 6:33975
**Shohet, J.L.,** *See* Johnson, J.L., 6:34182
**Short, D.R.,** Extension of a spur overlap model for the radiolysis of water to include high linear energy transfer regions, 6:33617
**Siczewicz, P.,** *See* Nutt-Powell, T.E., 6:33102
**Sidles, P.H.,** *See* McClelland, J.F., 6:33169
**Simay, G.,** *See* Dybeck, R., 6:33264
**Simcoe, E.J.,** *See* McFadden, C.R., 6:32864
**Simmons, C.S.,** Analysis of column tracer experiments by a stochastic-convective transport method, 6:33923 (PNL-SA—9478)
**Simmons, G.J.,** Preliminary report on a theory of authentication, 6:34195 (SAND—81-1007C)
**Simmons, M.,** *See* Craig, P., 6:33399
**Simmons, W.W.,** Aberrations and focusability in large solid-state-laser systems, 6:34186 (UCRL—85645)
**Simonen, E.P.,** Pulsed-irradiation creep in nickel, 6:33530 (PNL-SA—9266)
*See* Henager, C.H. Jr., 6:33532
**Simpkin, A.J.,** High-mass-flux coal gasifier. Final report, Phase III, 6:32812 (DOE/ET/14674—16)
**Simpson, F.B.,** *See* Haroldsen, R.O., 6:33089
**Sims, W.,** *See* Leipuner, L.B., 6:33688
**Sinclair, S.A.,** Wood resources and utilization patterns in the North Central Region and energy needs for the manufacture of wood products, 6:33114 (MASEC/R—81-005)
**Singer, R.,** *See* Derrick, M., 6:33973
**Singh, J.J.,** Measurement of moisture depth distribution in composite materials using positron lifetime technique, 6:33789 (CONF-800433—, pp 258-267)
**Singh, M.S.,** *See* Wang, C.L., 6:34072
**Sivak, L.D.,** Geographic distribution of the OTEC resource off the south and east coasts of the Florida Peninsula, 6:33150 (DOE/ER/05518—1)
**Skarshaug, N.H.,** 8 x 8 fuel surveillance program at Monticello site - end of Cycle 4: second post-irradiation inspection, September 1975, 6:33293 (DOE/ET/34031—3)
8 x 8 fuel surveillance program at Monticello site - end of Cycle 5: third post-irradiation inspection, September 1977, 6:33294 (DOE/ET/34031—4)
8 x 8 fuel surveillance program at Monticello site - end of Cycle 6: fourth post-irradiation inspection, October 1978, 6:33295 (DOE/ET/34031—5)
**Skehan, J.W.,** Exploration of coal and anthracitic carbonaceous shale resources, Narragansett Basin, Massachusetts and Rhode Island. Final report, 1 October 1979-30 April 1981, 6:32899 (DOE/RA/20029—T1)
**Skelly, J.M.,** Analysis of fluorine contamination from industrial sources, 6:33907 (CONF-800433—, pp 512-523)
**Skinderowicz, B.,** Subsidence prediction and control. Phase I. The state of knowledge in Poland concerning the influence of mining exploitation on the surface. Final report, 6:32911 (DOE/TIC—11481)
**Skoberne, F.,** Inertial fusion program, January 1-June 30, 1979, 6:34175 (LA—8114-PR)
**Slager, T.L.,** *See* Palopoli, S.F., 6:32829
**Slagle, D.,** Kinetics of oxydesulfurization of Upper Freeport coal, 6:32838
**Slate, S.C.,** *See* Peters, R.D., 6:33041
**Slater, D.C.,** *See* Charatis, G., 6:34061
**Smart, J.E.,** Adenovirus type 2 early proteins: assignment of the early region 1A proteins synthesized in Vivo and in Vitro to specific mRNAs, 6:33874
**Smelser, S.,** *See* Clark, J., 6:33255, 6:33256
**Smith, A.C. Jr.,** Moving-ring field-reversed mirror reactor, 6:34151 (CONF-801011—(Vol.3), pp 885-893)
**Smith, A.N.,** *See* Mitchell, H.A., 6:32841
**Smith, B.W.,** *See* Jones, E.M., 6:33947
**Smith, C.J.,** *See* Parker, J.T., 6:33225
**Smith, D.D.,** Offsite environmental monitoring report. Radiation monitoring around United States nuclear test areas, calendar year 1980, 6:33802 (EPA/600—4-81-047)
**Smith, D.L.,** *See* Meadows, J.W., 6:34040
*See* Morgan, G.D., 6:34143
**Smith, G.A.,** *See* Bobbie, R.J., 6:33917
**Smith, G.C.,** Particulate control for industrial coal fired boilers: the reverse gas fabric filter method, 6:32879
**Smith, G.W.,** *See* Shearer, J.A., 6:32954
**Smith, J.E.,** *See* Borek, C., 6:33849
**Smith, J.L.,** Hill plots and americium, 6:34048

*See* Clawson, C.W., 6:33957
**Smith, L.**, *See* Faltens, A., 6:34110
**Smith, L.A.**, *See* Caldwell, C.S., 6:34133
**Smith, M.I.**, Application of MORT analysis to emergency preparedness for nuclear power stations, 6:33362 (PNL-SA—9316)
**Smith, P.J.**, One-dimensional model for pulverized coal combustion and gasification, 6:32837
**Smith, R.W.**, *See* Moore, A.R., 6:33117, 6:33118
**Smith, S.A.**, *See* Watts, R.L., 6:33135
**Smith, S.D.**, *See* Lee, S.H.D., 6:33269
**Smits, R.G.**, Gas cooled electrical leads for use on forced cooled superconducting magnets, 6:33637 (LBL—12783)
**Smoot, L.D.**, *See* Smith, P.J., 6:32837
**Smyrl, W.H.**, *See* Kramer, C.M., 6:33148
**Snow, G.C.**, *See* Krill, W.V., 6:32945
**Snowden, R.**, *See* Turner, W.D., 6:33124
**Snyder, F.**, *See* Blank, M.L., 6:33864
*See* Wykle, R.L., 6:33850
**Sohns, D.**, Hydrogenation or recovery of acetylene: an economic comparison, 6:32978
**Somerville, L.P.**, *See* Nitschke, J.M., 6:34031
**Sommer, W.F.**, *See* Kmetyk, L.N., 6:33522
**Somorjai, G.A.**, Fundamental interactions, 6:33569 (LBL—12000, pp 229-333)
Surface science of heterogeneous catalysis: possible applications in atmospheric sciences, 6:33590 (LBL—12986)
**Sondericker, J.**, Production and use of high-grade silicon-diode temperature sensors, 6:33678 (BNL—30005)
**Sondericker, J.H.**, *See* Bamberger, J.A., 6:33683
*See* Brown, D.P., 6:33684
**Soper, A.K.**, Instrument for liquids, amorphous and power diffraction, 6:33578 (LA-UR—81-2531)
**Soprano, D.R.**, *See* Borek, C., 6:33849
**Sorrell, L.**, *See* Nutt-Powell, T.E., 6:33102
**Souers, P.C.**, *See* Alire, R.M., 6:34097
**Sousa, D.C.**, *See* Toth, K.S., 6:34024
**Sowerby, B.D.**, Nuclear techniques for the on-line bulk analysis of coal, 6:33781 (CONF-800433—, pp 645-661)
**Soyster, A.L.**, Evaluating the role of uncertainty in electric utility capacity planning, 6:33390 (DOE/EIA/10612—T26)
Evaluating the role of uncertainty in electric utility capacity planning (Appendices B and C), 6:33419 (DOE/EIA/10612—T26-Apps.B-C)
**Sparkman, T.**, Solar photovoltaics: a bibliography with abstracts. Quarterly update, April-June 1981, 6:33122 (TAC/SP—81-002)
Solar power generation: a bibliography with abstracts. Quarterly update, January-March 1981, 6:33093 (TAC-STPG—81-001)
**Specht, J.R.**, *See* McKeown, R.D., 6:34001
**Speyer, R.F.**, Devitrification kinetics of cadmium-germanium-arsenide glasses, 6:33558 (DOE/ER/01198—1367)
**Spitzberg, D.B.**, *See* Cawley, C.N., 6:33823
**Spong, D.A.**, *See* Uckan, N.A., 6:34065
**Sprevak, D.**, *See* McWilliams, B., 6:33250
**Springborg, R.**, Perspective on individual regions: the Middle East, 6:33415 (EPRI-WS—79-182, pp 3.14.1-3.14.7)
**Spyrou, N.M.**, *See* Othman, I., 6:33867
**Squires, A.M.**, *See* Taylor, L.T., 6:32843
**Squires, R.R.**, *See* Wiberg, K.A., 6:33608
**Sredniawski, J.J.**, Surface pumping system for TFTR impurity and density control, 6:34163 (CONF-801011—(Vol.3), pp 1024-1033)
**Srivastava, V.J.**, Hybrid biothermal conversion of biomass to methane, 6:33084
**Stacey, W.M. Jr.**, INTOR workshop, 6:34077 (CONF-801011—(Vol.1), pp 40-46)
**Stacy, L.E.**, Storage requirement definition study. final report, 6:33143 (NASA-CR—163882)
**Stang, R.G.**, *See* Henager, C.H. Jr., 6:33532
**Stanley, J.T.**, *See* Cost, J.R., 6:33523
**Starrfield, S.**, Hydrodynamic studies of the nova outburst, 6:33950
**Starrfield, S.G.**, New instability strip for hot degenerates, 6:33949
**Stauffer, T.**, Rent-skimmers, techniques for risk minimization, and impact on incentives, 6:33409 (EPRI-WS—79-182, pp 3.5.1-3.5.5)
**Stearns, R.D.**, *See* Chartier, V.L., 6:33286, 6:33287
**Stearns, R.L.**, Experimental study of the sigma-nucleon system through the reaction d(K,$\pi$)SIGMA N. Progress report, January 1, 1981-December 31, 1981, 6:33967 (DOE/ER/04195—5)
**Stecklein, G.L.**, Develop a winch-drawn dozer blade equipment system: modification A010-spoil-plane for leveling surface mine spoils. Semi-annual technical progress report, 6:32893 (DOE/ET/12394—T2)
**Steeden, M.F.**, *See* Fulmer, C.B., 6:34013
**Steele, V.E.**, Unstable cellular differentiation in adenosquamous cell carcinoma, 6:33856
**Steele, W.G.**, *See* Gordon, J.D., 6:34102
**Steele, W.G. Jr.**, *See* Kumar, R.A., 6:33436
**Steenhoek, L.E.**, New techniques in atomic and molecular laser spectroscopy, 6:33600
**Stein, F.P.**, *See* Dissinger, G.R., 6:32852
**Stein, W.E.**, *See* Warren, R.W., 6:33648
**Steinberg, M.**, APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste, 6:33318 (BNL—29899)
**Steinbugler, M.**, *See* Shell, P., 6:33077
**Steinhauer, L.C.**, Technology issues of tract plasma engineering, 6:34084 (CONF-801011—(Vol.1), pp 237-245)
*See* Willenberg, H.J., 6:34152
**Steinke, K.C.**, *See* Crotzer, M.E., 6:34099
**Steinmeyer, D.A.**, Second generation heliostat. Final report, 6:33197 (SAND—81-8177-Vol.1)
**Steinnes, E.**, *See* Rambaek, J.P., 6:33729
**Stella, R.**, *See* Ganzerli Valentini, M.T., 6:33812
**Stelson, P.H.**, *See* Auble, R.L., 6:34010
**Stelzer, I.M.**, Electric utilities face the next twenty years, 6:33429
**Stephenson, D.E.**, *See* Pratt, H.R., 6:33924
**Stephenson, E.J.**, *See* McKeown, R.D., 6:34001
**Stetz, A.W.**, *See* Kaellne, J., 6:33999
**Stevens, H.C.**, *See* Morgan, G.D., 6:34143
**Stevens, W.C.**, *See* Murphy, P.D., 6:33582
**Steward, S.A.**, *See* Alire, R.M., 6:34097
**Stewart, L.D.**, *See* Post, D.E., 6:34074
**Stewart, O.W.**, Our energy world energy in review, 6:33401
**Stojanoff, C.G.**, *See* Ochs, T., 6:33192
**Stokes, R.H.**, *See* Hansborough, L.D., 6:34113
**Stokstad, R.G.**, *See* Gomez del Campo, J., 6:34019
**Stone, R.**, *See* Braga, R.A., 6:34027
**Stonehart, P.**, Preparation and evaluation of advanced electrocatalysts for phosphoric acid fuel cells. Sixth quarterly report, April-June 1981, 6:33440 (DOE/NASA/0176—81/2)
**Stones, P.B.**, *See* Morgan, G.D., 6:34143
**Stopa, C.R.S.**, *See* Pecequilo, B.R.S., 6:33788
**Strait, E.J.**, *See* Kerst, D.W., 6:34192
**Straka, W.C.**, *See* Jones, E.M., 6:33947
**Strand, R.C.**, *See* Borenstein, S.R., 6:33686
**Strass, P.K.**, *See* Jensen, B.L., 6:33807
**Strebin, R.S. Jr.**, *See* Brauer, F.P., 6:33767
**Streckert, H.H.**, *See* Karas, B.R., 6:33105
**Streuli, R.A.**, Diminished osmotic fragility of human erythrocytes following the membrane insertion of oxygenated sterol compounds, 6:33855
**Strietwieser, A. Jr.**, *See* Edelstein, N.M., 6:33620
**Stroube, W.B. Jr.**, Application of neutron activation analysis in a regulatory agency, 6:33883 (CONF-800433—, pp 424-426)
**Struble, G.L.**, *See* Girshick, F., 6:34026
**Struss, R.G.**, *See* McClelland, J.F., 6:33169
**Stuart, M.L.**, *See* Robison, W.L., 6:33828
**Suarez, A.A.**, *See* Pecequilo, B.R.S., 6:33788
**Sudarshan, E.C.G.**, *See* Mukunda, N., 6:34049
**Suenaga, M.**, Superconducting properties of $(Nb,Ti)_3Sn$ wires fabricated by the bronze process, 6:33502 (BNL—30019)
*See* Okuda, S., 6:33501
**Sugarbaker, E.**, *See* Horen, D.J., 6:34020
**Suidan, M.T.**, Treatment of coal-conversion wastewater with the powdered activated carbon-contact-stabilization activated-sludge process. First annual technical progress report, February 1, 1981-July 31, 1981, 6:32867 (DOE/PC/30233—T2)
**Sullivan, D.**, *See* Charatis, G., 6:34061
**Sullivan, P.W.**, Incremental cooling load determination for passive direct gain heating systems, 6:33173 (LBL—12048)
**Sun, Y.**, *See* Yin, D., 6:32973
**Sundaresan, S.**, Diffusion and reaction in a stagnant boundary layer about a carbon particle--6. effect of water vapor on the pseudo-steady-state structure, 6:32847
**Sundberg, R.E.**, Moorhead district heating. Phase II. Final report, 6:33473 (DOE/CS/20074—1)
**Sunier, J.W.**, *See* Burke, D.G., 6:34022
*See* Flynn, E.R., 6:34021
**Sutton, W.R.**, Enhanced fusion product heating via the fast magnetosonic instability, 6:34052 (CONF-801011—(Vol.1), pp 254-260)

**Suzuki, M.,** Non-leptonic weak decay rate of explicitly flavored heavy mesons, 6:33976
**Suzuki, N.,** Substoichiometric isotope dilution analysis of tin in coal fly ash, 6:33737 (CONF-800433—, pp 671-684)
**Swain, Y.T.,** *See* Kraemer, F.W., 6:32937
**Sweigard, R.J.,** Evaluation of the potential of alternative land use plans for surface mined land, 6:32887 (ANL/LRP-TM—20, pp 147-168)
**Swenson, D.A.,** *See* Hansborough, L.D., 6:34113
**Swift, W.M.,** *See* Lee, S.H.D., 6:33269
**Swisher, J.H.,** United States Department of Energy thermal energy storage program, 6:33373 (DOE/RL/01830—T6)
**Symolon, P.D.,** Manual for use with the computer code SUPERENERGY: data reduction version, 6:33304 (DOE/ET/37240—74TR)
**Szydlowski, R.F.,** *See* McClelland, J.F., 6:33169

## T

**Tabakoff, W.,** *See* Beacher, B., 6:32943
*See* Kotwal, R., 6:33267
**Taddeucci, T.N.,** *See* Horen, D.J., 6:34020
**Tagart, S.W. Jr.,** *See* Nickell, R.E., 6:33289
**Takagi, J.,** *See* Iguchi, T., 6:34090
**Takahashi, Y.,** *See* Tanaka, S., 6:34098
**Takeda, Y.,** Random search algorithm for spectrum analysis, 6:33774 (CONF-800433—, pp 36-44)
**Takeshita, T.,** Some thermoelectric properties of the light rare earth sesquiselenides ($R_2Se/sub\ 3\text{-}x/$), 6:33559 (IS-M—329)
**Talwar, R.,** Energy savings from the Minnesota low-income weatherization programme, 6:33397
**Tanaka, S.,** Recent tritium handling experiments at the University of Tokyo, 6:34098 (CONF-801011—(Vol.1), pp 502-508)
**Tang, W.M.,** *See* Rewoldt, G., 6:34068
**Tang, Z.,** Field pilot test to demonstrate the whole process of water flooding in the Daqing oil field, 6:32972
**Tani, B.S.,** *See* Bates, J., 6:33540
**Tanihata, I.,** Two-proton correlation measurements in 800 and 400 MeV/nucleon heavy-ion reactions, 6:34008
**Tanner, J.T.,** *See* Stroube, W.B. Jr., 6:33883
**Tarman, P.B.,** *See* Srivastava, V.J., 6:33084
**Tarvin, J.A.,** *See* Charatis, G., 6:34061
**Tassicker, O.J.,** Coal blending by continuous nuclear assay, 6:32932 (EPRI-WS—79-236, pp 5.1-5.21)
**Taylor, G.E. Jr.,** *See* Tingey, D.T., 6:33908
**Taylor, J.D.,** *See* Smits, R.G., 6:33637
**Taylor, L.T.,** Organically bound metals in a solvent-refined coal: metallograms for a Wyoming subbituminous coal, 6:32843
*See* Dorn, H.C., 6:32832, 6:32833
**Taylor, T.S.,** *See* Sevier, D.L., 6:34172
**Templeton, D.H.,** *See* Edelstein, N.M., 6:33620
**Tenenbein, A.,** *See* Johnson, M.E., 6:34200
**Tennery, V.J.,** Structure-property correlations for $TiB_2$-based ceramics densified using active liquid metals, 6:33546 (CONF-810856—1)
US ceramic heat exchanger technology: status and opportunities, 6:33253 (CONF-810946—1)
**Tenney, F.H.,** Technology of controlled nuclear fusion, 6:34075 (CONF-801011—(Vol.1))
Technology of controlled nuclear fusion, 6:34101 (CONF-801011—(Vol.2))
Technology of controlled nuclear fusion, 6:34138 (CONF-801011—(Vol.3))
**Teofilo, V.L.,** *See* Bailey, V., 6:34168
**Terai, M.,** Distribution pattern of small and trace elements in human cancerous tissues and normal human tissues, 6:33878 (CONF-800433—, pp 427-436)
**Terrell, J.,** *See* Fenimore, E.E., 6:33937
**Tewari, K.C.,** *See* Palopoli, S.F., 6:32829
**Thadani, V.,** Comparison of hydrostatic extrusion versus wire drawing as a method of producing $Nb_3Sn$ superconducting wire, 6:33499 (BNL—29941)
**Theriault, P.,** *See* Bateman, G., 6:34169
**Thiele, C.H.,** *See* Gant, R.E., 6:33479
**Thieme, L.G.,** High-power baseline and motoring test results for the GPU-3 Stirling engine, 6:33490 (DOE/NASA/51040—31)
**Thode, L.E.,** Radiation source, 6:34191
**Thomas, G.,** *See* Gronsky, R., 6:33699
**Thomas, J.F.,** *See* Daw, C.S., 6:32948
**Thomas, M.T.,** *See* Jones, R.H., 6:33531
**Thome, D.J.,** *See* Smith, D.D., 6:33802
**Thompson, J.L.,** Microautoradiography: a useful technique for investigating radionuclide transport in geologic media, 6:33797 (CONF-800433—, pp 321-325)
**Thompson, M.N.,** *See* Pywell, R.E., 6:34002
**Thornton, J.A.,** Cadmium sulfide/copper sulfide heterojunction cell research by sputter deposition. Quarterly technical progress report, December 1, 1980-February 28, 1981, 6:33119 (SERI/PR—9296-T1)
**Thornton, S.T.,** *See* Dennis, L.C., 6:34003
**Thornton, T.A.,** *See* Caldwell, C.S., 6:34133
**Thorpe, R.K.,** Example of rock fracture characterization for modeling purposes, 6:33038 (LBL—11566, pp 37-42)
**Tieman, D.J.,** *See* Butz, T.R., 6:33006
**Tingey, D.T.,** Variation in plant response to ozone: a conceptual model of physiological events, 6:33908 (CONF-8009172—1)
**Tinnel, E.P.,** Preparation of magnetic anomaly profile and contour maps from DOE-NURE aerial survey data. Volume I: processing procedures, 6:32999 (ORNL/CSD/TM—155-Vol.1)
**Tipton, D.G.,** Effect of mechanical cleaning on seawater corrosion of candidate OTEC heat exchanger materials. Part 2. Tests with Amertap sponge rubber balls, 6:33149 (ANL/OTEC-BCM—018)
**Toaff, S.,** *See* Derrick, M., 6:33973
**Tobias, C.W.,** *See* Evans, J.W., 6:33378
**Tobin, A.,** *See* Chang, J.Y., 6:34132
**Tobin, R.J.,** Experimental studies in CDA work-energy attenuation. Quarterly technical progress report No. 22, 1 April- 30 June 1980, 6:33347 (DOE/SF/70097—T8)
**Todd, A.M.M.,** *See* Yamazaki, K., 6:34069
**Todreas, N.E.,** *See* Symolon, P.D., 6:33304
**Tohline, J.E.,** Effect of rotation on the hydrodynamics of stellar collapse, 6:33945
**Tokos, J.,** Water analysis methods at the integrated Lake Watershed Acidification Study Laboratory, Raquette Lake, NY, 6:33809 (BNL—51396)
**Tollaksen, S.L.,** *See* Edwards, J.J., 6:33848
**Tomza, U.,** *See* Maenhaut, W., 6:33844
**Tong, H.,** *See* Krill, W.V., 6:32945
**Tonnessen, K.,** *See* Harte, J., 6:33822
**Toohey, R.E.,** Radioactivity measurements of former military personnel exposed to weapon debris, 6:33892
**Tool, G.,** *See* Koepke, K., 6:33676
**Toossi, R.,** *See* Chang, S., 6:33750
**Tosic, M.,** Density- and frequency-dependent selection at the Mdh-2 locus in Drosophila pseudoobscura, 6:33863
**Toth, K.S.,** $\alpha$-decay rate of $^{188}Pb$, 6:34024
**Trachsel, C.A.,** *See* Graumann, D.W., 6:34107
**Trauth, C.A. Jr.,** Guidance for implementing an Environmental, Safety, and Health Assurance Program. Volume I. A model plan for Institutional Environmental, Safety, and Health Assurance Programs, 6:33920 (SAND—81-0632)
**Trautner, N.,** *See* Christensen, P.R., 6:34016
**Trego, A.L.,** Status of FMIT, 6:34130 (CONF-801011—(Vol.2), pp 1734-1739)
**Trester, P.W.,** *See* Cheng, E.T., 6:33064
*See* Sevier, D.L., 6:34172
**Trevino, A.A.,** Planning an integrated Mexican petrochemical industry, 6:32979
**Trexler, D.T.,** Low-to-moderate temperature geothermal resource assessment for Nevada, area specific studies. Final report, June 1, 1980-August 30, 1981, 6:33207 (DOE/NV/10039—3)
**Trigger, K.R.,** *See* Kovar, F.R., 6:33716
**Tripkovic, A.V.,** *See* Adzic, R.R., 6:33605
**Troth, D.L.,** *See* Novick, A.S., 6:32950
**Truhan, J.J.,** Fabricating thin beryllium windows for X-ray applications, 6:33706
**Trumbore, C.N.,** *See* Short, D.R., 6:33617
**Tsai, S.C.,** *See* Mattice, J.S., 6:33915
**Tsaros, C.L.,** *See* Paganessi, J.E., 6:32942
**Tserng, K.Y.,** Convenient synthesis of 3-keto bile acids by selective oxidation of bile acids with silver carbonate-Celite, 6:33851
**Tsuchiya, H.M.,** *See* Hoffmann, M.R., 6:33871
**Tucker, B.A.,** *See* Calloway, N.E., 6:33353
**Tufts, W.,** *See* Womack, W., 6:32926
**Turco, M.,** Feeding dry fly ash without flooding and flushing, 6:32927 (EPRI-WS—79-236, pp 2.78-2.91)
**Turel, Z.R.,** *See* Ganesan, R., 6:33814

**Turillon, P.P.,** *See* Lynch, F.E., 6:33631
**Turner, L.R.,** *See* Alcorn, J.S., 6:34089
**Turner, M.A.,** Comparative mutagenesis and interaction between near-ultraviolet (313- to 405-nm) and far-ultraviolet (254-nm) radiation in Escherichia coli strains with differing repair capabilities, 6:33900
**Turner, W.D.,** Mississippi County Community College Solar Photovoltaic Project. Final report, 6:33124 (DOE/ET/20347—T1)
**Tydd, C.B.,** *See* Lane, G.J., 6:33660

## U

**Uckan, N.A.,** Beta limits in EBT and their implications for a reactor, 6:34065 (ORNL/TM—7857)
**Uesaka, M.,** *See* Miya, K., 6:34085
**Umek, A.M.,** *See* Redekopp, R.D., 6:33310
**Uo, K.,** *See* Johnson, J.L., 6:34182

## V

**Valente, I.M.,** Biogeochemical prospecting for gold by neutron activation analysis, 6:33793 (CONF-800433—, pp 470-479)
**Valentin, R.A.,** *See* Youngdahl, C.K., 6:33364
**van der Sloot, H.A.,** Classification of coal by trace analysis using INAA-clusteranalysis and leaching of precipitator ash, 6:33780 (CONF-800433—, pp 621-635)
**van der Werf, S.Y.,** *See* Christensen, P.R., 6:34016
**Van Deurzen, C.H.H.,** Spectrum and energy levels of quadrupole-ionized vanadium (V v), 6:33603
**Van Howe, K.R.,** *See* Koppe, R.H., 6:33392
**Van Nostrand, R.C.,** *See* Lembke, L.L., 6:33763
**Van Sickle, A.H.,** *See* Rowsome, R.J., 6:32894
**Vance, E.R.,** Structural damage from fission fragment irradiation in crystalline nuclear waste phases, 6:33022 (DOE/ET/41900—5)
**Vandenput, G.C.,** *See* Pecequilo, B.R.S., 6:33788
**Vandermeer, R.A.,** Effects of tensile deformation on the strain memory behavior of uranium-niobium α″ martensite, 6:33534 (Y/DV—134)
**VanDevender, J.P.,** Drivers for light ion fusion, 6:34111 (CONF-801011—(Vol.2), pp 1403-1408)
High voltage, magnetically switched pulsed power systems, 6:33658 (SAND—81-0754C)
**Vanecek, V.,** *See* Madron, F., 6:33472
**Vantine, H.C.,** *See* Erickson, L.M., 6:33715
**Varley, D.T. III,** Computer modeling of an all-secondary explosive hot-wire device, 6:33708 (LA—8930-MS)
**Vartsky, D.,** *See* Ellis, K.J., 6:33905
*See* Ettinger, K.V., 6:33838, 6:33868, 6:33906
**Venkataramiah, A.,** Studies on toxicity of OTEC plant components on marine animals from the Gulf of Mexico. Final report, September 1, 1978-November 30, 1980, 6:33909 (DOE/ET/20512—T1)
**Verderber, R.,** *See* Berman, S., 6:33454
*See* Selkowitz, S., 6:33453
**Verdingh, V.,** *See* Berthelot, C., 6:33810
**Verdouw, A.J.,** Demonstration of waste-sludge incinerator fuel reduction: pilot project report, 6:33476 (DOE/CS/20321—1)
**Videbaek, F.,** *See* Christensen, P.R., 6:34016
**Vidich, C.,** Solar access and land use planning: a bibliography, 6:33103
**Vilchis, F.R.,** *See* Witze, P.O., 6:33488
**Vine, E.N.,** *See* Thompson, J.L., 6:33797
**Viren, J.R.,** *See* Roth, H.D., 6:33910
**Viswanathan, V.K.,** Optical analysis and alignment applications using the infrared Smartt interferometer, 6:34176 (LA-UR—81-2468)
Phase aberrations and beam cleanup techniques in carbon-dioxide laser fusion systems, 6:34178 (LA-UR—81-2523)
Use of Zernike polynomials and interferometry in the optical design and assembly of large carbon-dioxide laser systems, 6:34179 (LA-UR—81-2524)
**Vitunac, E.A.,** *See* Colijn, H., 6:32934
**Vogt, J.R.,** Nuclear methods in environmental and energy research, 6:33784 (CONF-800433—)
**Vojnovich, T.,** *See* Andersson, C.A., 6:33547
**Voss, D.E.,** *See* Cohen, S.A., 6:34051

## W

**Wackerle, J.,** Global kinetics for the shock-induced decomposition of heterogeneous explosives, 6:33709 (LA-UR—81-1835)
*See* Ginsberg, M.J., 6:33710
**Wade, J.E.,** Wind power prospecting using aerial reconnaissance, 6:33237
**Waganer, L.M.,** *See* DeFreece, D.A., 6:34166
**Waggoner, M.C.,** *See* Harrar, J.E., 6:33583
**Wagner, J.,** *See* Nutt-Powell, T.E., 6:33181
**Wagner, L.M.,** *See* Truhan, J.J., 6:33706
**Wagner, P.,** *See* Peterson, E.J., 6:32995
**Wagoner, C.L.,** Measurement of fundamental properties characterizing coal minerals and fireside deposits. First quarterly technical progress report, 1 April 1981-30 June 1981, 6:32859 (DOE/PC/40266—1)
**Wahi, K.K.,** Numerical modeling of earthquake effects on underground tunnels, 6:33030 (DPST—81-262, pp 14p, Paper 3)
**Wahlig, M.,** Overview of active solar absorption/Rankine cooling program, 6:33174 (LBL—13054-Rev.)
**Walker, R.L.,** *See* Kennett, R.G., 6:33972
**Wall, J.D.,** *See* Turner, W.D., 6:33124
**Wallace, J.H.,** *See* Jester, W.A., 6:33765
**Wallace, R.M.,** *See* Bibler, N.E., 6:33028
**Walsh, R.W.,** Solar consumer assurance: an assessment of mechanisms in the Northeast, 6:33183 (NESEC—9)
**Walters, E.C.,** *See* Borison, A.B., 6:33424, 6:33425, 6:33426
**Walters, L.C.,** Development and performance of metal fuel elements for fast breeder reactors, 6:33316
**Walters, W.B.,** Angular-correlation and coincidence studies of excited $0^+$ and other levels in the transitional Ce nuclides $^{142}$Ce, $^{144}$Ce, $^{146}$Ce and $^{148}$Ce, 6:34017 (BNL—29690)
**Waltz, E.W.,** *See* Verdouw, A.J., 6:33476
**Wampler, F.B.,** Lifetimes of electronically excited $UF_6$ in the presence of inorganic quenchers, 6:33615
**Wang, C.K.,** *See* Sah, C.T., 6:33123
**Wang, C.L.,** Design of neutron streak camera for fusion diagnostics, 6:34072 (UCRL—86162)
Hyper-filter-fluorescer spectrometer for fusion x-ray diagnostics, 6:34073 (UCRL—86163)
**Wang, J.S.Y.,** Introduction to numerical modeling of thermohydrologic flow in fractured rock masses, 6:33048 (LBL—11566, pp 3-13)
**Wang, P.,** Occurrence of oil in the complex fault-blocks in the Jiyang sag, 6:32965
**Wang, S.,** *See* Weisman, J., 6:33349
**Wang, S.T.,** *See* Alcorn, J.S., 6:34089
**Wang, T.S.,** Algorithms developed to obtain particular numerical solutions to the ideal MHD equilibrium problem, 6:34058 (GA-A—16400)
**Wang, X.,** Mechanism of the formation of diapiric structural traps in Dongying depression, Shandong, 6:32962
**Wangler, T.P.,** *See* Hansborough, L.D., 6:34113
**Warburton, E.K.,** Precision energy measurement of γ rays from short-lived activities, 6:34009
**Warburton, P.M.,** Preliminary evaluation of two stress-analysis computer programs based on the displacement-discontinuity and finite-element methods, 6:32905 (CSIRO—3)
**Warinner, D.K.,** LMFBR fuel-design environment for endurance testing, primarily of oxide fuel elements with local faults, 6:33303 (CONF-8008111—1)
**Warner, D.D.,** *See* Davidson, W.F., 6:34023
**Warren, E.L.,** *See* Horvath, D., 6:33487
**Warren, M.,** *See* Wahlig, M., 6:33174
**Warren, R.W.,** Status of the free-electron laser experiment at Los Alamos, 6:33648 (LA-UR—81-2568)
**Warren, W.E.,** Circumferential stresses and crack opening displacements at a fractured well bore, 6:33932 (SAND—81-1271)
**Watanabe, T.,** Effects of binder on the properties of $TiB_2$ based cermets, 6:33551 (ORNL-tr—4766)
**Waters, L.C.,** Chromatographic evidence that the AAA-coding isoacceptor of lysine tRNA primes DNA synthesis in murine mammary tumor virus, 6:33875
**Watson, J.S.,** *See* Canon, R.M., 6:33469
**Watt, J.S.,** *See* Sowerby, B.D., 6:33781

**Watts, R.L.,** Photovoltaic product directory and buyers guide, 6:33135 (PNL—3853)
**Wayland, J.R.,** *See* Fox, R.L., 6:32971
**Weaver, T.A.,** *See* Bolivar, S.L., 6:33014, 6:33015
**Webb, J.D.,** Optical transparency of inexpensive salt solutions for construction of density-gradient ponds, 6:33199 (SERI/RR—641-615)
**Webb, R.B.,** *See* Turner, M.A., 6:33900
**Webber, C.E.,** *See* Roberts, J.G., 6:33869
**Weber, C.F.,** *See* Maudlin, P.J., 6:33312
**Weber, W.J.,** *See* Fahey, J.A., 6:33591
**Webster, J.M.,** *See* Hepworth, J.K., 6:33325
**Wechsler, M.S.,** *See* Hsu, C.H., 6:33518
**Wecksung, G.W.,** *See* Bolivar, S.L., 6:33014
**Weertman, J.,** *See* Kmetyk, L.N., 6:33522
**Wegrzyn, J.,** Real time coarse particle mass measurements in a high temperature and pressure coal gasifier process treatment, 6:32805 (BNL—22952)
Real-time coarse-particle mass measurements in a high-temperature/pressure coal-gasifier process treatment, 6:32806 (BNL—29953)
**Weimer, W.C.,** *See* Laul, J.C., 6:33581
**Weirick, L.J.,** *See* Fox, R.L., 6:32971
**Weisheit, J.C.,** *See* Post, D.E., 6:34074
**Weisman, J.,** REFUEL: a computer program for automated BWR fuel management. Final report, 6:33319 (EPRI-NP—1920)
Studies of transition boiling heat transfer with saturated water at 1-4 bar. Final report, 6:33349 (EPRI-NP—1899)
**Weiss, D.L.,** *See* Brownell, J.H., 6:34062
**Weisser, D.C.,** *See* Auble, R.L., 6:34010
**Weitl, F.L.,** *See* Moerlein, S.M., 6:33623
**Welch, D.O.,** Interaction of stress with the martensitic phase transition in A15 compounds, 6:33500 (BNL—30016)
**Welch, M.J.,** *See* Moerlein, S.M., 6:33623
**Wells, J.W.,** Tennessee Valley Authority atmospheric fluidized-bed combustor simulation interim annual report, January 1-December 31, 1980, 6:33265 (ORNL/TM—7847)
**Wendell, J.H.,** *See* Dugundji, J., 6:33241
**Werner, A.,** *See* Brown, D.P., 6:33684
**Werner, A.P.,** Heat-load measurement of prototype cryogenic magnets and leads for the ISABELLE project, 6:33682 (BNL—30010)
**Wesling, G.C.,** *See* Stacy, L.E., 6:33143
**West, J.,** *See* Noble, J.P., 6:33493
**Western, W.R.,** *See* Braga, R.A., 6:34027
**Whealton, J.H.,** Electrode design and performance of the ORNL positive ion sources, 6:34181 (ORNL/TM—7879)
**Wheeler, J.C.,** *See* Cox, J.P., 6:33943
**Whipple, T.A.,** *See* Dalder, E.N.C., 6:33640
**White, A.S.,** *See* Enever, J.R., 6:32918
**White, C.L.,** *See* Inouye, H., 6:33536
**White, C.W.,** *See* Alton, G.D., 6:33668
**White, D.C.,** *See* Bobbie, R.J., 6:33917
**White, D.J.,** Low NO/sub x/ combustion systems for burning heavy residual fuels and high-fuel-bound nitrogen fuels, 6:32951
**White, G.C.,** Factors affecting radionuclide availability to vegetables grown at Los Alamos, 6:33903
**White, K.,** Manganese glass-molybdenum metallized and copper brazed 99.5% alumina ceramics, 6:33549 (MLM—2850)
**White, M.D.,** *See* Anklam, T.M., 6:33343
**White, N.M.,** Parametric sensitivity study for solar-assisted heat-pump systems. Final report, 6:33186 (SERI/TR—98288-1)
**White, R.W.,** *See* Gentry, R.A., 6:33619
**Whited, R.C.,** Radiation detection system using semiconductor detector with differential carrier trapping and mobility, 6:33692
**Whitley, J.B.,** Status of low Z coatings for fusion reactor applications, 6:34134 (CONF-801011—(Vol.2), pp 1794-1801)
**Whitley, R.H.,** *See* Berwald, D.H., 6:34120
**Whitney, R.R.,** *See* Kaellne, J., 6:33999
**Whittle, T.,** *See* Blank, M.L., 6:33864
**Wiberg, K.A.,** Thermochemical studies of carbonyl reactions. 2. Steric effects in acetal and ketal hydrolysis, 6:33608
**Wiedermann, A.H.,** *See* Shin, Y.W., 6:33296
**Wielopolski, L.,** *See* Ettinger, K.V., 6:33868
**Wiener, D.P.,** Economics of surface mine reclamation, 6:32883 (ANL/LRP-TM—20, pp 45-54)
**Wierenga, P.J.,** *See* Gee, G.W., 6:33804
**Wiernik, M.,** Error-free binary dilution method for the preparation of ppB-level liquid standards, 6:33570 (CONF-800433—, pp 332-336)
**Wiffen, F.W.,** *See* Scott, J.L., 6:34126
**Wild, J.F.,** *See* Hulet, E.K., 6:34030
**Wilde, H.R.,** PIXE analysis of biological and environmental samples using a proton microprobe, 6:33734 (CONF-800433—, pp 306-312)
**Wilde, P.,** Environmental programs for ocean thermal energy conversion (OTEC), 6:33154 (LBL—12977)
*See* Venkataramiah, A., 6:33909
**Wildman, G.C.,** *See* McCormick, C.L., 6:32968
**Wildung, R.E.,** Effects of oil-shale solid-waste disposal on water quality: current knowledge, information requirements, and research strategy, 6:32997 (PNL-SA—9792)
**Wilkinson, P.D.,** *See* Wilks, W.H., 6:32826
**Wilks, W.H.,** Particulate control in process area 12 (solvent-refined coal process and deashing), 6:32826 (DOE/OR/03054—3, pp 89-98)
**Willard, K.E.,** Two-dimensional analysis of human lymphocyte proteins: I. An assay for lymphocyte effectors, 6:33847
**Wille, G.W.,** *See* Davis, J.W., 6:34137
**Willenberg, H.J.,** TRACT fusion reactor studies, 6:34152 (CONF-801011—(Vol.3), pp 894-902)
*See* Steinhauer, L.C., 6:34084
**Williams, E.,** Review of the literature on the use of trommels in waste processing and resource recovery, 6:33474 (DOE/CS/20167—6)
**Williams, F.,** *See* Adur, A.M., 6:33553
**Williams, J.A.,** *See* Coleman, M.C., 6:33326
*See* Jolliffe, V.C., 6:33328
**Williams, J.G.,** *See* Ahmad, A., 6:33731
*See* Turner, W.D., 6:33124
**Williams, K.E.,** *See* Nitschke, J.M., 6:34031
**Williams, R.E.,** Feasibility of trace multielement analysis by 14-MeV neutron activation, 6:33787 (CONF-800433—, pp 216-230)
**Wilson, J.R.,** *See* Bowers, R.L., 6:33944
**Wilson, R.L.,** *See* Collins, H.D., 6:33330
**Wilson, T.W.,** *See* Gray, L.W., 6:33572
**Winkelmann, F.,** *See* Curtis, R., 6:33455
**Winkler, G.,** *See* Meadows, J.W., 6:34040
**Winston, J.G.,** *See* Warren, R.W., 6:33648
**Winters, R.R.,** Neutron cross section measurements using the ORELA: the stable tellurium isotopes (n,γ), $^{238}$U(n,n′), $^{232}$Th(n,n′), $^{187}$Os(n,n′), $^{186\ 187\ 189}$Os(n,nn′γ), and $^{205}$Tl(n,nγ). Progress report, September 1, 1980-September 1, 1981, 6:33991 (DOE/ER/02696—11)
**Wiorkowski, J.,** *See* Cawley, C.N., 6:33823
**Wiringa, R.B.,** Calculation of correlation functions in nuclear matter, 6:34032
**Wise, M.B.,** *See* Abbott, L.F., 6:33978
**Wiser, W.H.,** Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, October-December 1979, 6:32813 (DOE/ET/14700—1)
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1980, 6:32814 (DOE/ET/14700—2)
*See* Lytle, J.M., 6:32849
**Witherspoon, P.A.,** *See* Narasimhan, T.N., 6:33232
*See* Noorishad, J., 6:33929
**Witze, P.O.,** Stroboscopic laser shadowgraph study of the effect of swirl on homogeneous combustion in a spark-ignition engine, 6:33488
**Wogman, N.A.,** *See* Laul, J.C., 6:33581
**Woklenhauer, W.C.,** *See* DeFreece, D.A., 6:34166
**Wold, C.,** *See* Sargent, G.A., 6:32936
**Wolf, A.P.,** *See* Kutzman, R.S., 6:33904
*See* Schlyer, D.J., 6:33779
**Wolf, D.A.,** *See* Butz, T.R., 6:33006
**Wolfe, T.C.,** *See* Kessler, R.C., 6:32854
**Wolfe, W.B.,** Achievements, findings, and lessons of the Phenix LMFBR power plant experience. Final report, 6:33305 (EPRI-NP—1973)
**Wolfe, W.P.,** *See* Migliore, P.G., 6:33248
**Wolfsberg, K.,** *See* Thompson, J.L., 6:33797
**Womack, W.,** Feeding coal into a pulverizer at Monsanto's Soda Springs plant, 6:32926 (EPRI-WS—79-236, pp 2.68-2.77)
**Wong, C.P.C.,** Moving ring field-reversed mirror blanket design considerations, 6:34146 (CONF-801011—(Vol.3), pp 765-773)
*See* Cheng, E.T., 6:33064
**Wood, B.W.,** *See* Hill, M.W., 6:33775
**Wood, G.O.,** Respirator canister testing for radioiodine, 6:33644
**Wood, J.C.,** *See* Horvath, D., 6:33487
**Wood, J.L.,** *See* Braga, R.A., 6:34027

**Wood, L.,** Concerning technical means for dealing with aspects of the near-term information onslaught, 6:34198 (UCRL—86581)
**Wood, R.E.,** *See* Lytle, J.M., 6:32849
**Wood, S.A.,** *See* Henderson, J.M., 6:33354, 6:33357
**Woodhouse, J.J.,** *See* Moorhead, A.J., 6:33363
**Woodley, R.E.,** Oxygen potentials of plutonia and urania-plutonia solid solutions, 6:33541
**Woodruff, E.M.,** *See* Kindle, C.H., 6:33220
**Woodruff, G.L.,** *See* Ribe, F.L., 6:34125
*See* Rowe, D.S., 6:34139
**Woodside, P.R.,** Comments on oil and gas reserves in Mexico, 6:33416 (EPRI-WS—79-182, pp 3.15.1-3.15.14)
**Woody, M.C.,** *See* Hagaman, E.W., 6:32857
**Wooltorton, B.,** Field assessment of hydraulic fracturing as a stress measurement technique for near-surface applications: Stage 1, 6:32916
**Wooltorton, B.A.,** *See* Enever, J.R., 6:32920
**Workhoven, R.M.,** *See* Dudley, V.E., 6:33195
**Wray, W.O.,** Passive-solar retrofit study for the United States Navy, 6:33170 (LA-UR—81-2500)
**Wright, J.D.,** Design and economics of direct-contact salt hydrate storage systems, 6:33203 (SERI/TP—631-1163)
**Wruck, D.,** *See* Ochs, T., 6:33192
**Wu, C.T.,** *See* Cheng, T.C., 6:33282
**Wu, J.R.,** *See* Fulmer, C.B., 6:34013
**Wu, K.C.,** Analysis of cooldown performance for ISABELLE helium refrigerator, 6:33681 (BNL—30009)
*See* Bamberger, J.A., 6:33683
*See* Brown, D.P., 6:33679, 6:33684
**Wuebbles, D.J.,** Summary of the LLNL one-dimensional transport-kinetics model of the troposphere and stratosphere: 1981, 6:33952 (UCID—19185)
**Wulfe, M.,** *See* Fuller, F.H., 6:33132
**Wykle, R.L.,** Enzymatic synthesis of 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine, a hypotensive and platelet-aggregating lipid, 6:33850
**Wyman, C.E.,** SERI Solar-Energy-Storage Program, 6:33202 (SERI/TP—620-1344)
**Wyman, R.H.,** *See* Loomis, H.H., 6:33656

## X

**Xie, G.,** Occurrence of the oil pool in the metamorphosed basement in Yaerxia in the western part of the Jiuquan Basin, 6:32963

## Y

**Yachnin, S.,** *See* Streuli, R.A., 6:33855
**Yacobucci, H.G.,** *See* Novick, A.S., 6:32950
*See* White, D.J., 6:32951
**Yamakawa, K.A.,** *See* Sah, C.T., 6:33123
**Yamazaki, K.,** Axisymmetric stability of vertically asymmetric tokamaks at large beta poloidal, 6:34069 (PPPL—1831)
**Yang, S.,** *See* Zhang, X., 6:33645
**Yang, T.F.,** *See* Montgomery, D.B., 6:34079
**Yang, Y.,** *See* Hou, X., 6:33662
**Yao, C.Y.,** *See* Chao, A.W., 6:33666
**Yasuda, I.,** Magnetic bearings, 6:33646 (LA-tr—81-19)
**Yasuda, M.,** *See* Terai, M., 6:33878
**Yasumura, S.,** *See* Ellis, K.J., 6:33905
**Yeargan, J.R.,** *See* Turner, W.D., 6:33124
**Yeates, R.,** *See* Enever, J.R., 6:32901, 6:32921
**Yeh, H.C.,** *See* Cheng, Y.S., 6:33704
**Yesavage, V.F.,** *See* Kidnay, A.J., 6:32860
**Yin, D.,** Rational rate of recovery and well density in the development of carbonate pools in Renqiu, 6:32973
**Yntema, J.L.,** *See* Billquist, P.J., 6:33677
**Yokell, M.D.,** Economics of reclamation, 6:32881 (ANL/LRP-TM—20, pp 3-36)
**Yoo, H.I.,** Silicon solar cell process development, fabrication, and analysis. Ninth quarterly report, 1 January 1981-31 March 1981, 6:33111 (DOE/JPL/955089—81/11)
**Yoshikawa, M.,** *See* Iso, Y., 6:34156
**Yoshikawa, S.,** Helical equilibrium, 6:34067 (PPPL—1829)
OCLATOR: the one coil low aspect toroidal reactor, 6:34189
**Young, D.C.,** *See* Cronauer, D.C., 6:32834
**Young, L.M.,** *See* Warren, R.W., 6:33648
**Young, N.E.,** Remote handling methods on TFTR, 6:34160 (CONF-801011—(Vol.3), pp 1002-1008)
**Young, S.L.,** *See* Richards, R.R., 6:33596
**Youngblood, R.W.,** Neutron scattering studies of quasi one- and two-dimensional hydrogen-bonded ferroelectrics, 6:34037 (BNL—30004)
**Youngdahl, C.K.,** Pressure transient analysis of elbow-pipe experiments using the PTA-2 computer code, 6:33364
**Yu, C.M.,** Apparatus for electroplating particles of small dimension, 6:33567
**Yust, C.S.,** *See* Tennery, V.J., 6:33546

## Z

**Zabel, H.,** *See* Magerl, A., 6:33557
**Zabransky, R.F.,** *See* Knight, R.A., 6:32941
**Zachara, J.M.,** *See* Wildung, R.E., 6:32997
**Zahn, H.S.,** Tandem mirror and tokamak reactor maintainability comparison, 6:34109 (CONF-801011—(Vol.2), pp 1363-1369)
**Zalesky, M.P.,** Mechanical properties and hydrogen embrittlement of scandium, 6:33519 (IS-T—918)
**Zalkin, A.,** *See* Edelstein, N.M., 6:33620
**Zandt, G.,** *See* Pratt, H.R., 6:33924
**Zanzi, I.,** *See* Ellis, K.J., 6:33905
**Zardecki, A.,** *See* Gerstl, S.A.W., 6:33745
**Zatz, I.J.,** Finite-element analysis of the TEXTOR vacuum vessel under complex loading conditions, 6:34135 (CONF-801011—(Vol.2), pp 1811-1816)
**Zellmer, J.T.,** Stability of multilayer earthen barriers used to isolate mill tailings: geologic and geotechnological considerations, 6:33040 (PNL—3902)
**Zhan, Y.,** *See* Hou, X., 6:33662
**Zhang, J.,** *See* Wang, X., 6:32962
*See* Zhu, Y., 6:32974
**Zhang, X.,** Design and computation of diameter of rock bit, 6:33645
**Zhao, Y.,** Study of the emission performance of high-power klystrons: SLAC XK-5, 6:33673 (SLAC-TN—81-5)
**Zhu, Y.,** Study of the unsteady-state flow of slightly compressible fluid in naturally fractured reservoirs and its application in well test analysis, 6:32974
**Ziegler, E.N.,** Economics and control technology for NOx and particulate emissions from coal-fired power plants, 6:33272
**Ziff, J.J.,** Utilizing FFTF: the keystone for breeder development, 6:33311 (HEDL-SA—2386)
**Zimmerman, W.F.,** *See* Stacy, L.E., 6:33143
**Zimmerschied, M.K.,** *See* Powell, R.W., 6:33513
**Zoller, W.H.,** Nuclear activation analysis methods and the evaluation of volcanic deposits and emissions, 6:33728 (CONF-800433—, pp 96-105)
*See* Anderson, D.L., 6:33777
**Zuhr, R.A.,** *See* Alton, G.D., 6:33668
**Zukas, E.G.,** Pressure-induced transformation in a Pu-2at.% Al alloy, 6:33525 (LA-UR—81-2456)
*See* Hecker, S.S., 6:33524

# SUBJECT INDEX

The subject index is based on the use of subject descriptors selected from a controlled thesaurus of terms. Subject descriptors and qualifiers (subheadings) are selected and presented in the following format:

**SUBJECT DESCRIPTOR**
**Qualifier**
Title, (supplementary information), citation number, (report number)

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

## A


**A-15 COMPOUNDS**
*See BETA-W LATTICES*

**ABANDONED SHAFTS**
**Land Reclamation**
Costs of recontouring abandoned mined land, 6:32891 (ANL/LRP-TM—20)

**ABANDONED SITES**
**Decontamination**
Engineering assessment of inactive uranium mill tailings, Naturita Site, Naturita, Colorado, 6:33024 (DOE/UMT—012)
Engineering assessment of inactive uranium mill tailings, Shiprock site, Shiprock, New Mexico, 6:33026 (DOE/UMT—0104)
Summary of the engineering assessment of inactive uranium mill tailings, Naturita site, Naturita, Colorado, 6:33025 (DOE/UMT—012S)
Summary of the engineering assessment of inactive uranium mill tailings, Shiprock Site, Shiprock, New Mexico, 6:33027 (DOE/UMT—0104S)
**Surveys**
Economic considerations of reclaiming abandoned tailings ponds and dams, 6:32892 (ANL/LRP-TM—20)

**ABSORPTION SPECTROSCOPY**
**Comparative Evaluations**
Intercomparison of the integrating plate and the laser transmission methods for determination of aerosol absorption coefficients, 6:33754 (LBL—11986)

**ACETALS**
**Hydrolysis**
Thermochemical studies of carbonyl reactions. 2. Steric effects in acetal and ketal hydrolysis, 6:33608

**ACETYLENE**
**Removal**
Hydrogenation or recovery of acetylene: an economic comparison, 6:32978

**ACID ELECTROLYTE FUEL CELLS**
**Design**
Cell-module & fuel-conditioner development. 6th quarterly report, January-March 1981, 6:33439 (DOE/NASA/0161—7)
**Electrocatalysts**
Preparation and evaluation of advanced electrocatalysts for phosphoric acid fuel cells. Sixth quarterly report, April-June 1981, 6:33440 (DOE/NASA/0176—81/2)
**Hydrogen Generators**
Cell-module & fuel-conditioner development. 6th quarterly report, January-March 1981, 6:33439 (DOE/NASA/0161—7)
**Performance Testing**
Cell-module & fuel-conditioner development. 6th quarterly report, January-March 1981, 6:33439 (DOE/NASA/0161—7)

**ACID RAIN**
**Atmospheric Chemistry**
Activated carbon catalyzed oxidation of aqueous S(IV) species, 6:33747 (LBL—11986)
Aqueous reactions of nitrite and bisulfite, 6:33749 (LBL—11986)
Importance of soot particles and nitrous acid oxidizing $SO_2$ in atmospheric aqueous droplets, 6:33750 (LBL—11986)
Kinetics of the reaction between $NH_2OH$ and $SO_2$ in aqueous solutions, 6:33751 (LBL—11986)
Oxidation of $SO_2$ by wet soot particles: application to clouds, fogs, and plumes, 6:33748 (LBL—11986)
Role of fly ash in the catalytic oxidation of $SO_2$, 6:33752 (LBL—11986)
**Chemical Analysis**
Environmental pollutant studies: FY 1980 (Lead abstract), 6:33746 (LBL—11986)
Importance of soot particles and nitrous acid oxidizing $SO_2$ in atmospheric aqueous droplets, 6:33750 (LBL—11986)
**Environmental Effects**
Acid precipitation damage to aquatic ecosystems, 6:33822 (LBL—11986)
**Environmental Impacts**
$CO_2$ and acid rain, 6:33764
Environmental pollutant studies: FY 1980 (Lead abstract), 6:33746 (LBL—11986)

**ACIDS (ORGANIC)**
*See ORGANIC ACIDS*

**ACPR REACTOR**
**Fuel Elements**
Design and fabrication of the instrumented fuel elements for the Annular Core Research Reactor (ACRR), 6:33338 (SAND—80-2365)
**Thermocouples**
Design and fabrication of the instrumented fuel elements for the Annular Core Research Reactor (ACRR), 6:33338 (SAND—80-2365)

**ACROLEIC ACID**
*See ACRYLIC ACID*

**ACRR REACTOR**
*See ACPR REACTOR*

**ACRYLIC ACID**
**Chemical Radiation Effects**
New ion exchange membranes, 6:33616 (NASA-TM—81670)

**Metabolism**
Toxicokinetic studies possible after acute inhalation administration of compounds labeled with short-lived isotopes, 6:33904 (CONF-800433—)
**Toxicity**
Toxicokinetic studies possible after acute inhalation administration of compounds labeled with short-lived isotopes, 6:33904 (CONF-800433—)

**ACRYLIC POLYMERS**
*See POLYACRYLATES*

**ACTINIDES**
**Chemistry**
Low-energy nuclear sciences, 6:33620 (LBL—12000)
**Critical Mass**
Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)
**Meetings**
Actinides-1981, 6:33621 (LBL—12441)
**Sorption**
Autoradiographic studies of actinide sorption in groundwater systems, 6:33824 (CONF-800433—)

**ACTIVATED CARBON**
**Catalytic Effects**
Activated carbon catalyzed oxidation of aqueous S(IV) species, 6:33747 (LBL—11986)

**ACTIVATED SLUDGE PROCESS**
**Optimization**
Treatment of coal-conversion wastewater with the powdered activated carbon-contact-stabilization activated-sludge process. First annual technical progress report, February 1, 1981-July 31, 1981, 6:32867 (DOE/PC/30233—T2)

**ACTIVATION ANALYSIS**
*See also NEUTRON ACTIVATION ANALYZERS*
**Accuracy**
Accuracy in activation analysis: count rate effects, 6:33773 (CONF-800433—)
**Comparative Evaluations**
Determination of carbon in atmospheric aerosols by deuteron-induced nuclear reactions, 6:33579 (LBL—11986)
Determination of low-Z elements simultaneously by $^3$HE-induced nuclear wastes, 6:33580 (LBL—11986)
**Feasibility Studies**
Feasibility of trace multielement analysis by 14-MeV neutron activation, 6:33787 (CONF-800433—)
**Meetings**
Nuclear methods in environmental and energy research, 6:33784 (CONF-800433—)
**Performance Testing**
NAA as viewed from the perspective of International Atomic Energy Agency intercomparison tests, 6:33733 (CONF-800433—)
**Sensitivity**
Application of PIXE and INAA to biological materials: analysis of serum and serum albumin, 6:33844 (CONF-800433—)
**Standardization**
Error-free binary dilution method for the preparation of ppB-level liquid standards, 6:33570 (CONF-800433—)
Neutron activation analysis without multi-element standards, 6:33731 (CONF-800433—)

**ADENOCARCINOMAS**
*See CARCINOMAS*

**ADSORBENTS**
*See also ACTIVATED CARBON*
**Hydration**
Hydration enhanced sulfation of limestone and dolomite in the fluidized-bed combustion of coal, 6:32954
**Regeneration**
Environmental R and D needs for advanced power plants, 6:32895

**AERIAL PROSPECTING**
Wind power prospecting using aerial reconnaissance, 6:33237

**AERIAL SURVEYING**
**Equipment**
Laboratory and field portable system for calibrating airborne multispectral scanners, 6:33697 (EGG—1183-1777)

**AERODYNAMICS**
**Mathematical Models**
Performance analysis for horizontal axis wind turbines applicable to variable pitch or airbrake control, 6:33249

**AEROSOL GENERATORS**
**Design**
Stabilized aerosol generator, 6:33703

**AEROSOLS**
**Activation Analysis**
Environmental pollutant studies: FY 1980 (Lead abstract), 6:33746 (LBL—11986)
**Chemical Analysis**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
**Chemical Composition**
Low-Btu-gasifier emissions toxicology. Status report, December 1980, 6:32960 (LMF—85)
Resolving the sources of airborne particles for the regional air pollution studies, 6:33726 (CONF-800433—)
**Differential Thermal Analysis**
Determination of black carbon by thermal analysis, 6:33755 (LBL—11986)
**Environmental Effects**
Intercomparison of the integrating plate and the laser transmission methods for determination of aerosol absorption coefficients, 6:33754 (LBL—11986)
**Environmental Transport**
Assessment of the long-range transport of residential woodstove fine-particulate emissions for two future United States energy scenarios, 6:33761 (PNL-SA—9606)
**Inhalation**
Method of determining glass in rat lung after exposure to a glass fiber aerosol, 6:33914
**Mutagen Screening**
Low-Btu-gasifier emissions toxicology. Status report, December 1980, 6:32960 (LMF—85)
**Thermal Analysis**
Environmental pollutant studies: FY 1980 (Lead abstract), 6:33746 (LBL—11986)
**Toxicity**
Low-Btu-gasifier emissions toxicology. Status report, December 1980, 6:32960 (LMF—85)

**AGGLUTINATION**
*See ANTIGEN-ANTIBODY REACTIONS*

**AGRICULTURE**
*See also FARMS*
Evaluation of the passive solar for agriculture program, 6:33179 (MASEC/R—81-045)
**Energy Demand**
Models for forecasting energy use in the US farm sector. Final report, 6:33470 (EPRI-EA—1956(Vol.1))
**Power Demand**
ORNL rural electric-energy-demand forecasting model, 6:33427 (ORNL/TM—7863)

**AIR**
*See also EARTH ATMOSPHERE*
*SURFACE AIR*
**Radioactivation**
Activation of containment atmospheres in DT fusion facilities, 6:34095 (CONF-801011—(Vol.1))

**AIR INFILTRATION**
**Test Facilities**
Mobile infiltration test unit: its design and capabilities - preliminary experimental results, 6:33457 (LBL—12259)

**AIR POLLUTION**
*See also INDOOR AIR POLLUTION*
**Activation Analysis**
Nuclear activation analysis methods and the evaluation of volcanic deposits and emissions, 6:33728 (CONF-800433—)
**Biological Effects**
Membrane oxidative damage, 6:33854 (LBL—11986)
**Environmental Impacts**
Air pollution, 6:33771 (DOE/EP/10012—1)
**Environmental Transport**
Handbook on atmospheric diffusion models, 6:33724 (ATDL—81/5)

Identifying locations of dominant point sources of elements in urban atmospheres from large, multielement data sets, 6:33727 (CONF-800433—)
**Monitoring**
MAP3S/RAINE emissions inventory. Progress report, December 1980, 6:33725 (BNL—51378)
**Multi-Element Analysis**
Identifying locations of dominant point sources of elements in urban atmospheres from large, multielement data sets, 6:33727 (CONF-800433—)
Nuclear activation analysis methods and the evaluation of volcanic deposits and emissions, 6:33728 (CONF-800433—)
**Point Pollutant Sources**
Resolving the sources of airborne particles for the regional air pollution studies, 6:33726 (CONF-800433—)
**AIR POLLUTION CONTROL**
Working with asbestos, 6:33919 (K/RA—106)
**Research Programs**
Soot formation in synthetic fuel droplets. Third quarterly technical progress report, April 1 to June 30, 1981, 6:33743 (DOE/PC/30298—T3)
**AIR POLLUTION MONITORS**
**Performance**
Report of the instrumentation subgroup of indoor air quality, 6:33740 (CONF-801259—)
**AIR QUALITY**
**Correlations**
Evaluation of CHESS: New York asthma data 1971 to 1972. Volume 2, 6:33910 (EPRI-EA—1994(Vol.2))
**Economic Impact**
Technique for planning and managing industrial growth from the air-quality standpoint, 6:33835 (PNL-SA—9419)
**Measuring Methods**
Monitoring indoor air quality, 6:33739 (CONF-801259—)
**Research Programs**
Health effects: indoor air quality research strategy plan, 6:33885 (CONF-801259—)
Report of the control technology session of the workshop on indoor air quality research needs, 6:33741 (CONF-801259—)
**AIR SAMPLERS**
**Efficiency**
Precision of the all-glass impinger and the Andersen microbial impactor for air sampling in solid-waste handling facilities, 6:33763
**ALABAMA**
**Resource Recovery Facilities**
Opelika resource recovery project: report on the technological and economic evaluation, 6:33475 (DOE/CS/20243—1)
**ALAP**
*See RADIATION PROTECTION*
**ALASKA**
**Geochemical Surveys**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Aiaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
**ALBUMINS**
**Multi-Element Analysis**
Application of PIXE and INAA to biological materials: analysis of serum and serum albumin, 6:33844 (CONF-800433—)
**ALDEHYDES**
*See also BENZALDEHYDE FORMALDEHYDE*
**Ion-Molecule Collisions**
Gas-phase reactions of $Fe^+$ with ketones and ethers, 6:33960
**Liquid Column Chromatography**
Liquid-liquid chromatography fractionation of organic compounds in complex mixtures: application to automobile exhaust, 6:33575 (IS-T—914)
**ALFVEN WAVES**
**Kinetic Equations**
Kinetic theory of Alfven wave heating, 6:34057 (DOE/ET/53036—25)
**ALGORITHMS**
**Efficiency**
Random search algorithm for spectrum analysis, 6:33774 (CONF-800433—)
**ALKALIS**
*See HYDROXIDES*
**ALLOY NUCLEAR FUELS**
**Performance**
Development and performance of metal fuel elements for fast breeder reactors, 6:33316
**ALLOY-HD-8077**
*See NICKEL BASE ALLOYS*
**ALLOY-HT-9**
**Cracks**
Miniaturized fatigue crack growth specimen technology and results, 6:33517 (HEDL-SA—2475)
**ALLOY-MA-754**
*See NICKEL BASE ALLOYS*
**ALLOYS**
*See also HEAT RESISTING ALLOYS*
**Crystal Lattices**
Self-consistent approximation beyond the CPA: Part II, 6:33506 (CONF-810866—1(Draft))
**Electronic Structure**
Proceedings of the interdisciplinary meeting on hydrogen in metals, 6:33503 (CONF-800280—)
**Embrittlement**
Proceedings of the interdisciplinary meeting on hydrogen in metals, 6:33503 (CONF-800280—)
**Materials Testing**
Sulfidation resistance of high-temperature alloys tested in reducing and oxidizing atmospheres, 6:32840
**Mechanical Properties**
Role of engineering judgement and the computer in the management of material property data, 6:33495 (CONF-800804—43)
**Meetings**
Proceedings of the interdisciplinary meeting on hydrogen in metals, 6:33503 (CONF-800280—)
**Microstructure**
Self-consistent approximation beyond the CPA: Part II, 6:33506 (CONF-810866—1(Draft))
**Physical Properties**
Role of engineering judgement and the computer in the management of material property data, 6:33495 (CONF-800804—43)
**Research Programs**
Metals and Ceramics Division materials science program. Annual progress report for period ending June 30, 1981, 6:33529 (ORNL/TM—7970)
Research in materials. Annual report, 6:33497
**Stress Corrosion**
Proceedings of the interdisciplinary meeting on hydrogen in metals, 6:33503 (CONF-800280—)
**ALLOY-WAZ-16**
*See NICKEL BASE ALLOYS*
**ALPHA DOSIMETRY**
**Spark Chambers**
Imaging alpha particle detector (Patent), 6:33694
**ALPHA PARTICLES**
**Dose-Response Relationships**
Microdosimetry of lymphocytes irradiated by alpha particles, 6:33890 (PNL-SA—9315)
**Microdosimetry**
Microdosimetry of lymphocytes irradiated by alpha particles, 6:33890 (PNL-SA—9315)

**ALPHA REACTIONS**
**Total Cross Sections**
Energy dependence of nucleus-nucleus total cross sections, 6:34006
**ALPHA-TRANSFER REACTIONS**
**Excitation Functions**
New surface phenomena in heavy-ion-induced reactions, 6:33996
**ALTERNATE FUELS**
*See FUEL SUBSTITUTION*
*SYNTHETIC FUELS*
**ALUMINA**
*See ALUMINIUM OXIDES*
**ALUMINIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Materials Recovery**
Salt-soda sinter process for recovering aluminum from fly ash (Patent), 6:32868
**Permeability**
Low permeability materials for tritium and tritium removal with organic materials, 6:34097 (CONF-801011—(Vol.1))
**Physical Radiation Effects**
Effect of cyclic pulsed temperature on void growth in metals during irradiation, 6:33522 (LA-UR—81-2437)
**Positron Channeling**
Slow positrons in the study of surface and near-surface defects, 6:33953 (BNL—29798)
**Thermodynamic Properties**
Shock-compression measurements at pressures greater than 1 TPa, 6:33521 (LA-UR—81-2426)
**Voids**
Effect of cyclic pulsed temperature on void growth in metals during irradiation, 6:33522 (LA-UR—81-2437)
**ALUMINIUM 27 TARGET**
**Electron Reactions**
Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)
**Lithium 6 Reactions**
Elastic and inelastic scattering of 88 MeV $^{6}$Li ions, 6:34013
**ALUMINIUM ADDITIONS**
**Hydridation**
Hydride chemical compressor. Phase I, final report, 6:33631 (BNL—51369)
**ALUMINIUM ALLOYS**
*See also ALUMINIUM BASE ALLOYS*
**Corrosion**
Effect of mechanical cleaning on seawater corrosion of candidate OTEC heat exchanger materials. Part 2. Tests with Amertap sponge rubber balls, 6:33149 (ANL/OTEC-BCM—018)
**Phase Transformations**
Pressure-induced transformation in a Pu-2at.% Al alloy, 6:33525 (LA-UR—81-2456)
Temperature-induced transformation in a Pu-2at.% Al alloy, 6:33524 (LA-UR—81-2455)
**ALUMINIUM BASE ALLOYS**
**Physical Radiation Effects**
Microstructure and tensile properties of heavily irradiated 5052-0 aluminium alloy (Fast and thermal neutrons), 6:33538
**ALUMINIUM OXIDES**
**Catalytic Effects**
Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)
Exploratory study of coal-conversion chemistry. Quarterly report No. 9, March 20, 1980-June 19, 1980, 6:32816 (DOE/ET/14855—9)
Exploratory study of coal-conversion chemistry. Quarterly report, June 20, 1980-September 19, 1980, 6:32817 (DOE/ET/14855—12)
Surface science of heterogeneous catalysis: possible applications in atmospheric sciences, 6:33590 (LBL—12986)
**Recovery**
Evaluation of potential processes for recovery of metals from coal ash. Final report, 6:33469 (EPRI-CS—1992(Vol.1))
**Surface Treatments**
Manganese glass-molybdenum metallized and copper brazed 99.5% alumina ceramics, 6:33549 (MLM—2850)
**Thermal Conductivity**
Thermal conductivity measurements of insulators for fusion blankets, 6:33498 (BNL—29779)
**ALUMINIUM-AIR BATTERIES**
**Cost**
Development of the aluminum-air battery for electric vehicle applications, 6:33492 (UCRL—86560)
**Design**
Development of the aluminum-air battery for electric vehicle applications, 6:33492 (UCRL—86560)
Preliminary design and analysis of aluminum-air cells providing for continuous feed and full utilization of anodes, 6:33380 (UCID—19178)
**Performance**
Development of the aluminum-air battery for electric vehicle applications, 6:33492 (UCRL—86560)
**AMCHITKA ISLAND AREA**
**Radiation Monitoring**
Offsite environmental monitoring report. Radiation monitoring around United States nuclear test areas, calendar year 1980, 6:33802 (EPA/600—4-81-047)
**AMERICIUM**
**Recovery**
Chemistry research and development. Annual progress report, November 1, 1979-October 31, 1980, 6:33622 (RFP—3180)
**Superconductivity**
Hill plots and americium, 6:34048
**AMERICIUM 241**
**Ion Exchange Chromatography**
Recovery of americium-241 from aged plutonium metal, 6:33572 (DP—1577)
**Radiation Monitoring**
Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)
**Radioecological Concentration**
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)
**Recovery**
Recovery of americium-241 from aged plutonium metal, 6:33572 (DP—1577)
**Solvent Extraction**
Recovery of americium-241 from aged plutonium metal, 6:33572 (DP—1577)
**AMERICIUM COMPOUNDS**
**Solubility**
Nuclear waste management, 6:33589 (LBL—12000)
**AMINES**
*See also ANILINE*

*CATECHOLAMINES*
*CHLORAMINES*
*CYTOSINE*
*HYDROXYLAMINE*
*NITROGEN MUSTARD*
*RHODAMINES*

**Curing**
Effect of network structure on moisture absorption of epoxy resins, 6:33607

**Sorptive Properties**
Effect of network structure on moisture absorption of epoxy resins, 6:33607

**AMINOBENZENE**
*See ANILINE*

**AMINOGLYCIDES**
*See AMINES*

**AMMONIA**
**Toxicity**
Studies on toxicity of OTEC plant components on marine animals from the Gulf of Mexico. Final report, September 1, 1978-November 30, 1980, 6:33909 (DOE/ET/20512—T1)

**AMNION CELLS**
*See EMBRYONIC CELLS*

**ANAEROBIC DIGESTION**
**Chemical Reaction Kinetics**
Kinetics of acid-phase fermentation in anaerobic digestion, 6:33086

**ANGIOGRAPHY**
*See BLOOD VESSELS*

**ANILINE**
**Curing**
Effect of network structure on moisture absorption of epoxy resins, 6:33607

**Sorptive Properties**
Effect of network structure on moisture absorption of epoxy resins, 6:33607

**ANIMAL CELLS**
*See also CLONE CELLS*
*EMBRYONIC CELLS*
*STEM CELLS*
*TUMOR CELLS*
*XP CELLS*

**Biological Radiation Effects**
Abstracts of twenty-ninth annual meeting of the Radiation Research Society, Minneapolis, Minnesota, 31 May-4 June 1981 (Lead abstract), 6:33897

**ANIMAL FEEDS**
**Multi-Element Analysis**
Application of neutron activation analysis in a regulatory agency, 6:33883 (CONF-800433—)

**ANIMALS**
*(See also specific animal names.)*
*See also WILD ANIMALS*

**Radiation Monitoring**
Environmental monitoring in the vicinity of the Savannah River Plant. Annual report, 1980, 6:33801 (DPSPU—81-30-1)

**Radioactivity**
Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)

**ANNUAL CYCLE ENERGY SYSTEM**
**Computer Codes**
Data collection and processing for the ACES, 6:33459 (ORNL/CON—59)

**Data Acquisition**
Data collection and processing for the ACES, 6:33459 (ORNL/CON—59)

**Data Processing**
Data collection and processing for the ACES, 6:33459 (ORNL/CON—59)

**ANNUAL ENERGY STORAGE**
**Bibliographies**
Bibliography of the seasonal thermal energy storage library, 6:33374 (PNL—3645)

**ANNULAR CORE PULSE REACTOR**
*See ACPR REACTOR*

**ANNULAR CORE RESEARCH REACTOR**
*See ACPR REACTOR*

**ANTARES FACILITY**
**Alignment**
Optical analysis and alignment applications using the infrared Smartt interferometer, 6:34176 (LA-UR—81-2468)

**Cleaning**
Phase aberrations and beam cleanup techniques in carbon-dioxide laser fusion systems, 6:34178 (LA-UR—81-2523)

**Fabrication**
Optical tooling for Antares, 6:34177 (LA-UR—81-2469)

**Optical Systems**
Optical analysis and alignment applications using the infrared Smartt interferometer, 6:34176 (LA-UR—81-2468)
Use of Zernike polynomials and interferometry in the optical design and assembly of large carbon-dioxide laser systems, 6:34179 (LA-UR—81-2524)

**Research Programs**
Inertial fusion program, January 1-June 30, 1979, 6:34175 (LA—8114-PR)

**ANTIGEN-ANTIBODY REACTIONS**
**Seasonal Variations**
Agglutinating antibody to Aeromonas hydrophila in wild largemouth bass, 6:33877

**ANTIKAONS NEUTRAL**
**Rest Mass**
Large distance effects in CP violation and the $K^0$-anti $K^0$ mass matrix, 6:33984

**ANTIMONY**
**Metallurgical Effects**
Relative effects of S, Sb and P on the intergranular fracture of iron and nickel tested at cathodic potentials, 6:33531 (PNL-SA—9446)

**ANTIMUONS**
*See MUONS PLUS*

**ANTRIM SHALES**
*See BLACK SHALES*

**APARTMENT BUILDINGS**
**Solar Space Heating**
Solar energy system performance evaluation: Montecito Pines, Santa Rosa, California, November 1979-April 1980, 6:33188 (SOLAR/1045—80/14)

**Solar Water Heating**
Solar energy system performance evaluation: Montecito Pines, Santa Rosa, California, November 1979-April 1980, 6:33188 (SOLAR/1045—80/14)
Solar energy system performance evaluation: Cathedral Square, Burlington, Vermont, January 1980-December 1980, 6:33189 (SOLAR/1060—81/14)
Solar energy system performance evaluation: Forest City Dillon, Washington, DC, January 1980-December 1980, 6:33187 (SOLAR/1041—81/14)

**APPROPRIATE TECHNOLOGY**
**Federal Assistance Programs**
Appropriate energy technology in the US Pacific territories, 6:33389

**AQUATIC ECOSYSTEMS**
**Acidification**
Acid precipitation damage to aquatic ecosystems, 6:33822 (LBL—11986)

**Radionuclide Migration**
Environmental concentration and migration of $^{129}I$, 6:33767 (PNL-SA—9140)
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)

**AQUEOUS SOLUTIONS**
**Environmental Transport**
Analysis of column tracer experiments by a stochastic-convective transport method, 6:33923 (PNL-SA—9478)

**AQUIFERS**
**Compressed Air Energy Storage**
Reservoir stability studies, 6:33370 (PNL-SA—9782)

**Sensible Heat Storage**
Review of simulation techniques for aquifer thermal energy storage (ATES), 6:33375 (PNL—3769)

**ARCTIC REGIONS**
**Soot**
Soot in the Arctic, 6:33753 (LBL—11986)

**ARGON**
**Mass Spectroscopy**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
**ARGON 40 REACTIONS**
**Knock-Out Reactions**
Two-proton correlation measurements in 800 and 400 MeV/nucleon heavy-ion reactions, 6:34008
**ARIZONA**
**Geochemical Surveys**
Stream sediment detailed geochemical survey for Date Creek Basin, Arizona, 6:33006 (GJBX—243-81)
**ARMY PERSONNEL**
*See MILITARY PERSONNEL*
**AROMATICS**
*See also ANILINE*
*BIBENZYL*
*CONDENSED AROMATICS*
*PHENOLS*
*POLYCYCLIC AROMATIC HYDROCARBONS*
*TETRALIN*
*XYLENES*
**Chemical Bonds**
Model compound study of the mechanism of $sp^2$-$sp^3$ carbon-carbon cleavage during the reduction of coals (Bibenzyl, diphenylmethane, α-benzylnaphthalene), 6:33606 (CONF-810914—4)
**Chemical Reaction Kinetics**
Model compound study of the mechanism of $sp^2$-$sp^3$ carbon-carbon cleavage during the reduction of coals (Bibenzyl, diphenylmethane, α-benzylnaphthalene), 6:33606 (CONF-810914—4)
**Chemical Reactions**
Exploratory study of coal-conversion chemistry. Quarterly report No. 9, March 20, 1980-June 19, 1980 (Hydroxydiphenylmethane, diphenylether, diphenymethane), 6:32816 (DOE/ET/14855—9)
Exploratory study of coal-conversion chemistry. Quarterly report, December 20, 1979-March 19, 1980 (Ortho and para-hydroxydiphenylmethanes), 6:32815 (DOE/ET/14855—6)
Exploratory study of coal-conversion chemistry. Quarterly report, June 20, 1980-September 19, 1980 (Diphenylmethane, diphenyl ether), 6:32817 (DOE/ET/14855—12)
**Fluorescence Spectroscopy**
Two-laser induced selective infrared-visible fluorescence for thin film analysis, 6:33584
**Laser Spectroscopy**
Two-laser induced selective infrared-visible fluorescence for thin film analysis, 6:33584
**Liquid Column Chromatography**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**NMR Spectra**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**ARSENIC**
**Absorption Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Mass Spectroscopy**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
**ARSENIC FLUORIDES**
**Clathrates**
Processes and techniques, 6:32839 (LBL—12000)
**ASBESTOS**
**Air Pollution Control**
Working with asbestos, 6:33919 (K/RA—106)
**ASCORBIC ACID**
**Radiosensitivity Effects**
Influence of noncarcinogenic secondary factors on radiation carcinogenesis (In vitro; hamsters; x ray), 6:33896
**ASHES**
*See also FLY ASH*
**Hydraulic Transport**
Bottom ash handling from the 50's to the 90's, 6:32874 (EPRI-WS—79-236)
**Materials Handling**
Bottom ash handling from the 50's to the 90's, 6:32874 (EPRI-WS—79-236)
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)
Coal and ash handling in a typical industrial boiler plant, 6:33647
Oil ash handling case history, 6:32872 (EPRI-WS—79-236)
**Meetings**
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)
**Separation Processes**
Removal and recovery of fine size coal from coal preparation plant waters. Report No. 1: January 1, 1977-December 31, 1977, 6:32924 (DOE/TIC—11482)
**Transport**
Coal and ash handling in a typical industrial boiler plant, 6:33647
**Waste Disposal**
Ash disposal methods: Eastern and Western coal, 6:32876 (EPRI-WS—79-236)
Bottom ash handling from the 50's to the 90's, 6:32874 (EPRI-WS—79-236)
Cost of ash disposal, 6:32877 (EPRI-WS—79-236)
Design and operation of compact bottom ash basins for 500 MW of generating capacity, 6:32875 (EPRI-WS—79-236)
Solid-waste impacts of increased coal utilization, 6:32865 (BNL—24786)
**Water Removal**
Bottom ash handling from the 50's to the 90's, 6:32874 (EPRI-WS—79-236)
Design and operation of compact bottom ash basins for 500 MW of generating capacity, 6:32875 (EPRI-WS—79-236)
**ASTEROIDS**
**Collisions**
One dimensional hydrodynamics of asteroid-neutron star collisions, 6:33948
**Environmental Impacts**
Reduction of photosynthetically active radiation under extreme stratospheric aerosol loads, 6:33745 (LA—8938-MS)
**ASTHMA**
**Correlations**
Evaluation of CHESS: New York asthma data 1971 to 1972. Volume 2, 6:33910 (EPRI-EA—1994(Vol.2))
**ASTROCYTOMAS**
*See NEOPLASMS*
**ATMOSPHERIC CHEMISTRY**
**Research Programs**
Fundamental interactions, 6:33569 (LBL—12000)
**ATMOSPHERIC EXPOSURE CHAMBERS**
*See EXPOSURE CHAMBERS*
**ATOMIC ABSORPTION SPECTROSCOPY**
*See ABSORPTION SPECTROSCOPY*
**ATOMIC BOMBS**
*See NUCLEAR WEAPONS*
**ATOMIC EXPLOSIONS**
*See NUCLEAR EXPLOSIONS*
**ATOMIC WEAPONS**
*See NUCLEAR WEAPONS*
**ATTACHED GREENHOUSES**
**Design**
Heating and cooling applications of atriums and attached greenhouses. A state-of-the-art report, 6:33166 (DOE/SF/11511—T1)
**Performance**
Comparative thermal performance of direct gain, Trombe, and sunspace walls, 6:33158 (BNL—29970)

**Reviews**
Heating and cooling applications of atriums and attached greenhouses. A state-of-the-art report, 6:33166 (DOE/SF/11511—T1)

**AUSTENITIC STEELS**
**Embrittlement**
Preirradiation microstructrual development designed to minimize properties degradation during irradiation in austentic alloys, 6:33505 (CONF-810831—11)
**Physical Radiation Effects**
Preirradiation microstructrual development designed to minimize properties degradation during irradiation in austentic alloys, 6:33505 (CONF-810831—11)
**Swelling**
Preirradiation microstructrual development designed to minimize properties degradation during irradiation in austentic alloys, 6:33505 (CONF-810831—11)
**Yield Strength**
High strength austenitic alloys for generator retaining rings, 6:33527 (LBL—12000)

**AUSTRALIA**
**Coal Mines**
Depositional environments in the Barabala Coal Measures: Moura, Queensland, 6:32914
**Coal Mining**
Role of geomechanics research in Australian coal mines, 6:32915
**Energy Source Development**
Alternative liquid fuels, 6:33494
**Geological Surveys**
Depositional environments in the Barabala Coal Measures: Moura, Queensland, 6:32914
**Research Programs**
Status of solar energy research and development in Australia, 6:33090 (NP—1903916)
**Solar Energy**
Status of solar energy research and development in Australia, 6:33090 (NP—1903916)
**Wind Power Plants**
Integration of wind power into Australian electricity grids without storage: a computer simulation, 6:33238

**AUTOMOBILES**
**Gas Turbine Engines**
Cold-air performance of compressor-drive turbine of Department of Energy upgraded automobile gas turbine engine. I. Volute-manifold and stator performance, 6:33486 (DOE/NASA/1011—34)

**AUTORADIOGRAPHS**
*See IMAGES*

**AUTORADIOGRAPHY**
**Histological Techniques**
Autoradiographic technic for Plutonium, Polonium, and Promethium tissue sections, 6:33857
**Technology Assessment**
Tritium autoradiography, 6:33654 (DP-MS—81-12)

**AXEROPHTOL**
*See VITAMIN A*

## B

**BACTERIA**
*See also ESCHERICHIA COLI*
*HAEMOPHILUS*
*STREPTOMYCES*
**Biochemistry**
Characteristics of environmental isolates of Legionella pneumophila (Legionella), 6:33876
**Morphology**
Characteristics of environmental isolates of Legionella pneumophila (Legionella), 6:33876

**BAGHOUSES**
**Comparative Evaluations**
What baghouse is best for your industrial boiler: reverse air or pulse jet, 6:33273
**Materials**
What baghouse is best for your industrial boiler: reverse air or pulse jet, 6:33273
**Pressure Drop**
What baghouse is best for your industrial boiler: reverse air or pulse jet, 6:33273

**BALLASTS**
**Research Programs**
Energy-efficient lighting program, 6:33454 (LBL—11985)

**BALLOONING INSTABILITY**
**Computer Codes**
Comparison of results between the ballooning-modes codes BLOON and BALOON, 6:34063 (ORNL/CSD/TM—157)

**BANKS**
*See COMMERCIAL BUILDINGS*

**BARIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)

**BARIUM 136 TARGET**
**Triton Reactions**
$^{136}$sup(,)$^{138}$Ba(t,p) and the systematics of neutron pairing vibrations at N = 82, 6:34021

**BARIUM 138**
**Vibrational States**
$^{136}$sup(,)$^{138}$Ba(t,p) and the systematics of neutron pairing vibrations at N = 82, 6:34021

**BARIUM 138 TARGET**
**Triton Reactions**
$^{136}$sup(,)$^{138}$Ba(t,p) and the systematics of neutron pairing vibrations at N = 82, 6:34021

**BARIUM 140**
**Vibrational States**
$^{136}$sup(,)$^{138}$Ba(t,p) and the systematics of neutron pairing vibrations at N = 82, 6:34021

**BARYONIUM**
**Particle Production**
Progress report, October 1, 1980-June 30, 1981, 6:33966 (DOE/ER/03509—T1)

**BASALT**
**Creep**
Importance of creep failure of hard rock in the near field of a nuclear-waste repository, 6:33037 (LA-UR—81-2584)
**Sorptive Properties**
Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)

**BATTERIES (ELECTRIC)**
*See ELECTRIC BATTERIES*

**BAUXITE**
**Regeneration**
Studies of the regeneration of activated bauxite used as granular sorbent for the control of alkali vapors from hot flue gas of coal combustion, 6:33269 (ANL/CEN/FE—81-1)
**Sorptive Properties**
Studies of the regeneration of activated bauxite used as granular sorbent for the control of alkali vapors from hot flue gas of coal combustion, 6:33269 (ANL/CEN/FE—81-1)
**BCC LATTICES**
**Deformation**
Slip systems and solid solution softening/hardening in BCC metals (Low-temperature deformation), 6:33504 (CONF-810391—1)
**BEAM EXTRACTION**
**Efficiency**
Improved extraction of negative ion beams from the inverted sputter source, 6:33677
**BEAM INJECTION**
**Helical Configuration**
Helical axial injection concept for cyclotrons, 6:33670 (CONF-810944—1)
**BEAM INJECTION HEATING**
Radiation source (Patent), 6:34191
**BEAM STRIPPERS**
**Performance Testing**
Evaluation of carbon stripper foils for heavy-ion accelerators, 6:34010
**BEAN PLANT**
*See PHASEOLUS*
**BENZALDEHYDE**
**Metabolism**
Toxicokinetic studies possible after acute inhalation administration of compounds labeled with short-lived isotopes, 6:33904 (CONF-800433—)
**Toxicity**
Toxicokinetic studies possible after acute inhalation administration of compounds labeled with short-lived isotopes, 6:33904 (CONF-800433—)
**BERKELIUM 249 TARGET**
**Nitrogen 15 Reactions**
Search for an 80 ms spontaneous fission activity in bombardments of $^{249}$Bk with $^{15}$N, 6:34031
**BERYLLIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Fabrication**
Fabricating thin beryllium windows for X-ray applications, 6:33706
**Tissue Distribution**
Feasibility study for the in vivo measurement of silicon and beryllium by nuclear techniques, 6:33868 (CONF-800433—)
**BERYLLIUM 11**
**Beta-Minus Decay**
Precision energy measurement of $\gamma$ rays from short-lived activities, 6:34009
**Excited States**
Precision energy measurement of $\gamma$ rays from short-lived activities, 6:34009
**BERYLLIUM MODERATORS**
*See BERYLLIUM*
**BETA-W LATTICES**
**Electrolytes**
Improved beta-alumina electrolytes for advanced storage batteries, 6:33379 (LBL—12000)
**Research Programs**
Improved beta-alumina electrolytes for advanced storage batteries, 6:33379 (LBL—12000)
**BIBENZYL**
**Chemical Bonds**
Model compound study of the mechanism of $sp^2$-$sp^3$ carbon-carbon cleavage during the reduction of coals (Bibenzyl, diphenylmethane, $\alpha$-benzylnaphthalene), 6:33606 (CONF-810914—4)
**Chemical Reaction Kinetics**
Model compound study of the mechanism of $sp^2$-$sp^3$ carbon-carbon cleavage during the reduction of coals (Bibenzyl, diphenylmethane, $\alpha$-benzylnaphthalene), 6:33606 (CONF-810914—4)
**BI-GAS PROCESS**
Surface Coal Gasification, 6:32819 (DOE/METC/SP—110)
**BILE ACIDS**
**Methylation**
Convenient synthesis of 3-keto bile acids by selective oxidation of bile acids with silver carbonate-Celite, 6:33851
**BIOLOGICAL MATERIALS**
*(See also specific biological materials.)*
*See also BIOLOGICAL WASTES*
*BIOMASS*
*BODY FLUIDS*
*FOOD*
*FOREST LITTER*
*LEAVES*
*MILK*
*PLANTS*
*TISSUE EXTRACTS*
*TISSUES*
**Activation Analysis**
Environmental trace element analysis using short-lived nuclides, 6:33732 (CONF-800433—)
**Chemical Analysis**
Nuclear methods in environmental and energy research, 6:33784 (CONF-800433—)
**Isotope Dating**
Laser isotope dating: a new technique of radioisotope dating using lasers, 6:33791 (CONF-800433—)
**Molecular Biology**
Computer simulation of organic and biological molecules, 6:33846 (LBL—12979)
**Multi-Element Analysis**
Environmental trace element analysis using short-lived nuclides, 6:33732 (CONF-800433—)
Radiochemical-NAA studies of biological samples in connection with marine production of petroleum, 6:33817 (CONF-800433—)
Use of a synchrotron radiation x-ray microprobe for elemental analysis at the national synchrotron light source, 6:33790 (CONF-800433—)
**PIXE Analysis**
PIXE analysis of biological and environmental samples using a proton microprobe, 6:33734 (CONF-800433—)
**BIOLOGICAL REPAIR**
**Biological Pathways**
Analysis of resynthesis tracts in repaired Escherichia coli deoxyribonucleic acid, 6:33899
**Molecular Biology**
Molecular mechanisms of pyrimidine dimer excision in Saccharomyces cerevisiae: excision of dimers in cell extracts, 6:33901
**Radiosensitivity Effects**
Comparative mutagenesis and interaction between near-ultraviolet (313- to 405-nm) and far-ultraviolet (254-nm)

radiation in Escherichia coli strains with differing repair capabilities, 6:33900

**BIOLOGICAL WASTES**
**Multi-Element Analysis**
Application of neutron activation analysis in a regulatory agency, 6:33883 (CONF-800433—)

**BIOMASS**
*(All growing organic matter such as plants, trees, grasses, and algae.)*
*See also MAIZE*
*PLANTS*
*TREES*
*WOOD*
**Anaerobic Digestion**
Hybrid biothermal conversion of biomass to methane, 6:33084
**Liquefaction**
Thermochemical production of liquids from biomass, 6:33115 (PNL-SA—9246)
**Research Programs**
Thermal and electrochemical biomass conversion at SERI, 6:33121 (SERI/TP—622-1174)
**Thermochemical Processes**
Hybrid biothermal conversion of biomass to methane, 6:33084

**BIS-CHLOROETHYLAMINE**
*See NITROGEN MUSTARD*

**BISMUTH**
**Ion Exchange Chromatography**
Chromatographic separation of metal ions on macroreticular anion-exchange resins of a low capacity, 6:33587

**BISMUTH 199**
**Excited States**
Very slow M4 transitions and shell-model intruder states in $^{199}$sup(,)$^{201}$Bi, 6:34027
**Isomeric Transitions**
Very slow M4 transitions and shell-model intruder states in $^{199}$sup(,)$^{201}$Bi, 6:34027

**BISMUTH 201**
**Excited States**
Very slow M4 transitions and shell-model intruder states in $^{199}$sup(,)$^{201}$Bi, 6:34027
**Isomeric Transitions**
Very slow M4 transitions and shell-model intruder states in $^{199}$sup(,)$^{201}$Bi, 6:34027

**BITTER SPAR**
*See DOLOMITE*

**BITUMENS**
**Recovery**
Environmental, health, safety, and socioeconomic impacts associated with oil recovery from tar-sand deposits in the United States, 6:32998 (UCRL—53197)

**BLACK SHALES**
**Explosive Fracturing**
Small-scale experiments with an analysis to evaluate the effect of tailored pulse loading on fracture and permeability. Final report for Phase II, June 11, 1980-June 11, 1981, 6:32992 (DOE/MC/11577—T23)

**BLANKETS (BREEDING)**
*See BREEDING BLANKETS*

**BLAST EFFECTS**
**Fires**
Blast/fire interactions. Proceedings of conference held in Asilomar, California, May 18-21, 1980, 6:33717 (FEMA—2563F)

**BLOOD SERUM**
**Multi-Element Analysis**
Application of PIXE and INAA to biological materials: analysis of serum and serum albumin, 6:33844 (CONF-800433—)

**BLOOD VESSELS**
**Biological Radiation Effects**
Abstracts of twenty-ninth annual meeting of the Radiation Research Society, Minneapolis, Minnesota, 31 May-4 June 1981 (Lead abstract), 6:33897

**BODY**
*See also TISSUES*
**Radiation Doses**
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)

**BODY CENTERED CUBIC**
*See BCC LATTICES*

**BODY FLUIDS**
*See also MILK*
**Biochemistry**
Proteins of human semen. I. Two-dimensional mapping of human seminal fluid, 6:33848

**BOILERS**
*See also REFUSE-FUELED BOILERS*
**Design**
Summary report of the ABMA test program to update emissions and efficiency performance of industrial stoker-fired boilers (Tests on 18 different boiler installations), 6:33274
**Efficiency**
Summary report of the ABMA test program to update emissions and efficiency performance of industrial stoker-fired boilers (Tests on 18 different boiler installations), 6:33274
**Field Tests**
Summary report of the ABMA test program to update emissions and efficiency performance of industrial stoker-fired boilers (Tests on 18 different boiler installations), 6:33274
**Flue Gas**
Summary report of the ABMA test program to update emissions and efficiency performance of industrial stoker-fired boilers (Tests on 18 different boiler installations), 6:33274
**Pollution Control Equipment**
Particulate control for industrial coal fired boilers: the reverse gas fabric filter method, 6:32879
What baghouse is best for your industrial boiler: reverse air or pulse jet, 6:33273

**BOILING WATER REACTORS**
*See BWR TYPE REACTORS*

**BONE MARROW**
**Radiation Doses**
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)

**BONES**
*See SKELETON*

**BORAX**
**Physical Properties**
Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981, 6:33192 (DOE/CS/30174—T2Vol.1)

**BOREHOLES**
**Stress Analysis**
Circumferential stresses and crack opening displacements at a fractured well bore, 6:33932 (SAND—81-1271)

**BORON**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)

Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)

**BORON ADDITIONS**
**Amorphous State**
Structural relaxation rates in amorphous Metglas alloys $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_{80}B_{80}$, 6:33523 (LA-UR—81-2444)
**Electric Conductivity**
Structural relaxation rates in amorphous Metglas alloys $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_{80}B_{80}$, 6:33523 (LA-UR—81-2444)

**BOTTOMING CYCLES**
**Feasibility Studies**
Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 1. Executive summary, 6:33484 (DOE/CS/54224—T1-Vol.1)
Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 2. Final technical report, 6:33485 (DOE/CS/54224—T1-Vol.2)

**BRAIN**
**Multi-Element Analysis**
INAA studies of normal and diseased human brain, 6:33879 (CONF-800433—)

**BRAKING RADIATION**
*See BREMSSTRAHLUNG*

**BREAKUP REACTIONS**
**Spin Orientation**
Description of polarization analyzing powers for three-body breakup reactions, 6:33998

**BREASTS**
*See MAMMARY GLANDS*

**BREEDING BLANKETS**
**Design**
Design considerations for a high temperature $Li_2O$ flowing particulate blanket, 6:34139 (CONF-801011—(Vol.3))
Design considerations for high-temperature synthetic fuel production fusion reactors, 6:33064 (CONF-801011—(Vol.2))
First-wall/blanket design for the STARFIRE tokamak reactor, 6:34143 (CONF-801011—(Vol.3))
Lithium blanket module tests on the TFTR, 6:34147 (CONF-801011—(Vol.3))
Moving ring field-reversed mirror blanket design considerations, 6:34146 (CONF-801011—(Vol.3))
Neutronic and thermal performance of a blanket design for an inertially confined fusion commercial power reactor, 6:34141 (CONF-801011—(Vol.3))
Suppressed fission blanket concepts for inertial confinement fusion, 6:34120 (CONF-801011—(Vol.2))
**Heat Transfer**
Experimental investigation of the convective heat transfer characteristics of particle-bed type fusion blankets, 6:34144 (CONF-801011—(Vol.3))
**Neutron Reactions**
Blanket and shield nucleonic considerations for the Field-Reversed Mirror Small Reactor, 6:34093 (CONF-801011—(Vol.1))
Developments in blanket neutronics for CTR's, 6:34092 (CONF-801011—(Vol.1))
Neutron spectra and tritium production rate measurements in the one dimensional LiF slab geometry as a fusion reactor blanket benchmark experiment, 6:34090 (CONF-801011—(Vol.1))
Review of integral fusion blanket neutronic experiments, 6:34091 (CONF-801011—(Vol.1))
**Neutron Transport**
Review of neutronic design criteria, 6:34096 (CONF-801011—(Vol.1))

**BREMSSTRAHLUNG**
**Data Compilation**
Bremsstrahlung energy spectra from electrons of kinetic energy 1 keV $\leqq$ T $\leqq$ 2000 keV incident on neutral atoms 1 $\leqq$ Z $\leqq$ 92, 6:33959 (SAND—81-1337)
**Energy Spectra**
Bremsstrahlung energy spectra from electrons of kinetic energy 1 keV $\leqq$ T $\leqq$ 2000 keV incident on neutral atoms 1 $\leqq$ Z $\leqq$ 92, 6:33959 (SAND—81-1337)
**Spectra Unfolding**
Measurement of the $^{18}O$ photonuclear cross sections as a test of a bremsstrahlung unfolding technique, 6:34002

**BRINES**
**Phase Studies**
Processes and techniques, 6:32839 (LBL—12000)

**BROMINE**
**Photolysis**
Advanced isotope separation technology, 6:33612 (LBL—12000)

**BROOKHAVEN AGS**
*(Alternating-Gradient Synchrotron.)*
**Data Acquisition Systems**
Plans for Brookhaven Fastbus during the next $\pi \times 10^{16}$ nanoseconds, 6:33688 (BNL—30031)

**BUILDINGS**
*See also APARTMENT BUILDINGS*
*COMMERCIAL BUILDINGS*
*FEDERAL BUILDINGS*
*GREENHOUSES*
*HOUSES*
*PUBLIC BUILDINGS*
*RESIDENTIAL BUILDINGS*
*SCHOOL BUILDINGS*
**Air Infiltration**
Energy performance of buildings, 6:33451 (LBL—11985)
Mobile infiltration test unit: its design and capabilities - preliminary experimental results, 6:33457 (LBL—12259)
**Air Pollution Abatement**
Indoor air quality (Health hazards due to energy conservation measures), 6:33758 (LBL—12887)
**Air Pollution Control**
Indoor air quality (Health hazards due to energy conservation measures), 6:33758 (LBL—12887)
**Air Quality**
Building ventilation and indoor air quality, 6:33452 (LBL—11985)
**Energy Analysis**
DOE-2.1 building energy analysis group, 6:33455 (LBL—11985)
Energy efficiency buildings program, FY 1980, 6:33450 (LBL—11985)
Verification of BLAST by comparison with measurements of a solar-dominated test cell and a thermally massive building, 6:33172 (LBL—11387)
**Energy Audits**
Energy performance of buildings, 6:33451 (LBL—11985)
**Energy Efficiency**
Building energy data compilation, analysis, and demonstration, 6:33456 (LBL—11985)
Energy efficiency buildings program, FY 1980, 6:33450 (LBL—11985)
**Energy Efficiency Standards**
Potential environmental issues related to building energy performance standards, 6:33447 (DOE/CS/20205—T17)
**Photovoltaic Power Supplies**
Study of photovoltaic cost elements. Volume 1. Executive report. Volume 2. Project background. Final report, 6:33136 (SAND—81-7014/Vol.1-2)
Study of photovoltaic cost elements. Volume 3. Sandia National Laboratories photovoltaic systems design catalog. Final report, 6:33137 (SAND—81-7014/Vol.3)
**Retrofitting**
Building energy data compilation, analysis, and demonstration, 6:33456 (LBL—11985)
**Solar Space Heating**
Heating remote rooms in passive solar buildings, 6:33171 (LA-UR—81-2518)

**Stress Analysis**
Experimental and theoretical study of a tall building subjected to wind loading, 6:33632 (CONF-810742—2)
**Ventilation Systems**
Building ventilation and indoor air quality, 6:33452 (LBL—11985)
**Wind Loads**
Experimental and theoretical study of a tall building subjected to wind loading, 6:33632 (CONF-810742—2)

**BUILDINGS (CONTAINMENT)**
*See CONTAINMENT BUILDINGS*

**BUNDLE DIVERTORS**
**Design**
Bundle divertor studies, 6:34169 (CONF-801011—(Vol.3))

**BUNKER OILS**
*See RESIDUAL FUELS*

**BUNKERS**
*See HOPPERS*

**BURNERS**
*See also FLUIDIZED-BED COMBUSTORS*
*OIL BURNERS*
**Energy Efficiency**
Flame-retention head burner efficiency test results and analysis. Space-heating-equipment test program, 6:33446 (BNL—51321)
**Fabrication**
Effects of components of synfuels on soot formation. Quarterly technical progress report Number 3, April 1-June 30, 1981, 6:32947 (DOE/PC/30307—3)
**Fuel Consumption**
Flame-retention head burner efficiency test results and analysis. Space-heating-equipment test program, 6:33446 (BNL—51321)
**Installation**
Effects of components of synfuels on soot formation. Quarterly technical progress report Number 3, April 1-June 30, 1981, 6:32947 (DOE/PC/30307—3)

**BUTANE**
**Dehydrogenation**
Heat-supply system for a fluidized-bed reactor featuring an endothermic reaction, 6:32977

**BWR TYPE REACTORS**
*See also MONTICELLO REACTOR*
**Control Rooms**
Evaluation of proposed control room improvements through analysis of critical operator decisions. Final report, 6:33333 (EPRI-NP—1982)
**Fuel Cycle**
APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste, 6:33318 (BNL—29899)
**Fuel Management**
REFUEL: a computer program for automated BWR fuel management. Final report, 6:33319 (EPRI-NP—1920)
**Loss of Coolant**
Analysis of short-term reactor cavity transient, 6:33342 (CONF-810606—74)
Phased-mission system reliability analysis. Volume 2: computer code. Final report, 6:33350 (EPRI-NP—1945(Vol.2))
**Spent Fuel Elements**
APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste, 6:33318 (BNL—29899)
**Two-Phase Flow**
Hybrid numerical method for homogeneous equilibrium two-phase flows in one space dimension, 6:33296

## C

**CADMIUM**
**Ecological Concentration**
Study of heavy elements (Cd, Hg and Se) in the aquatic environment around Bombay by radiochemical neutron activation analysis, 6:33814 (CONF-800433—)
**Emission Spectroscopy**
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
**Environmental Transport**
Approach to Cadmium speciation in natural waters using $^{109}$Cd as radiotracer, 6:33818 (CONF-800433—)
**Mass Spectroscopy**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
**Spatial Distribution**
Approach to Cadmium speciation in natural waters using $^{109}$Cd as radiotracer, 6:33818 (CONF-800433—)
**Tissue Distribution**
In vivo measurement of cadmium in an occupationally-exposed population, 6:33905 (CONF-800433—)
**Toxicity**
In vivo measurement of cadmium in an occupationally-exposed population, 6:33905 (CONF-800433—)

**CADMIUM 113**
**Nuclear Magnetic Resonance**
High-resolution $^{113}$Cd NMR of solids. Correlation of spectra with the molecular structure of a decanuclear cadmium(II) complex, 6:33582

**CADMIUM ALLOYS**
**Phase Diagrams**
Phase relations in the thorium-cadmium system, 6:33540

**CADMIUM ARSENIDES**
**Crystal Growth**
Devitrification kinetics of cadmium-germanium-arsenide glasses, 6:33558 (DOE/ER/01198—1367)

**CADMIUM SULFIDE SOLAR CELLS**
**Environmental Impacts**
Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**Health Hazards**
Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**Performance Testing**
Cadmium sulfide/copper sulfide heterojunction cell research by sputter deposition. Quarterly technical progress report, December 1, 1980-February 28, 1981, 6:33119 (SERI/PR—9296-T1)

**CADMIUM SULFIDES**
**Environmental Impacts**
Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**Health Hazards**
Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**Sputtering**
Cadmium sulfide/copper sulfide heterojunction cell research by sputter deposition. Quarterly technical progress report, December 1, 1980-February 28, 1981, 6:33119 (SERI/PR—9296-T1)

**CAES**
*See COMPRESSED AIR ENERGY STORAGE*

**CAES PLANT**
*See COMPRESSED AIR STORAGE POWER PLANTS*

**CALCIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)

Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)

**CALCIUM 40 TARGET**
**Lithium 6 Reactions**
Elastic and inelastic scattering of 88 MeV $^{6}Li$ ions, 6:34013
**Proton Reactions**
Inclusive proton spectra and total reaction cross sections for proton-nucleus scattering at 800 MeV, 6:33997 (LA—8937-T)

**CALCIUM 48 TARGET**
**Lithium 6 Reactions**
Elastic and inelastic scattering of 88 MeV $^{6}Li$ ions, 6:34013

**CALCIUM CARBONATES**
**Decomposition**
Rate and activation enthalpy of decomposition of $CaCO_3$, 6:33595

**CALCIUM CHLORIDES**
**Physical Properties**
Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981, 6:33192 (DOE/CS/30174—T2Vol.1)

**CALCIUM FLUORIDES**
**Crystal Doping**
Equilibrium between type I and type II $M^{3+}$-$F_1^-$ complexes in alkaline earth fluorides, 6:33601

**CALCIUM OXIDES**
**Catalytic Effects**
Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)
**Chemical Reactions**
CaO interactions in the staged combustion of coal. Third quarterly technical progress report, April 1, 1981-June 30, 1981 (Reaction with $FeS_2$ and with sulfur), 6:32946 (DOE/PC/30301—3)

**CALCIUM SILICATES**
**Hexagonal Lattices**
Crystal structure and stoichiometry of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6$O/sub 2-1/2x/ system, 6:33591 (PNL-SA—9377)
**Stoichiometry**
Crystal structure and stoichiometry of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6$O/sub 2-1/2x/ system, 6:33591 (PNL-SA—9377)

**CALCIUM SULFATES**
**Chemical Reactions**
Chemical thermodynamic analysis of the interaction of 304 SS with the gases and the $CaSO_4$ deposit in the fluidized-bed combustor, 6:33507 (CONF-810943—2)

**CALIFORNIA**
*See also GEYSERS GEOTHERMAL FIELD*
*LONG VALLEY*
**Energy Sources**
Distributed energy systems in California's future: Interim report, Volume I, 6:33399 (LBL—6831-Rev.)
**Geothermal Resources**
Geothermal resources development project: Phase I, 6:33205 (DOE/ET/27167—T1)
**Government Policies**
Geothermal resources development project: Phase I, 6:33205 (DOE/ET/27167—T1)
**Residential Sector**
Solar energy for California's residential sector: progress, problems, and prospects, 6:33104

**CALORIMETERS**
Fusion energy calorimeter for the tokamak fusion test reactor, 6:34053 (CONF-801011—(Vol.3))

**CAMAC SYSTEM**
*(Computer Application to Measurement And Control.)*
Definitions of CAMAC terms, 6:33685 (DOE/ER—0104)

**CANADA**
**Underground Mining**
Emphasis in overseas research on underground coal mining: geomechanical implications (Australian report), 6:32904 (CSIRO—2)

**CANALS (WATERWAYS)**
*See INLAND WATERWAYS*

**CANCER**
*See NEOPLASMS*

**CANDU TYPE REACTORS**
**Spent Fuel Storage**
Possibility of multiple temperature maxima in geologic repositories for spent fuel from nuclear reactors, 6:33043

**CARBON**
*See also ACTIVATED CARBON*
*CARBON BLACK*
*GRAPHITE*
**Activation Analysis**
Determination of carbon in atmospheric aerosols by deuteron-induced nuclear reactions, 6:33579 (LBL—11986)
Determination of low-Z elements simultaneously by $^{3}HE$-induced nuclear wastes, 6:33580 (LBL—11986)
**Combustion Kinetics**
Diffusion and reaction in a stagnant boundary layer about a carbon particle--6. effect of water vapor on the pseudo-steady-state structure, 6:32847
**Lifetime**
Evaluation of carbon stripper foils for heavy-ion accelerators, 6:34010
**Thermal Analysis**
Determination of carbon in atmospheric aerosols by deuteron-induced nuclear reactions, 6:33579 (LBL—11986)
Determination of low-Z elements simultaneously by $^{3}HE$-induced nuclear wastes, 6:33580 (LBL—11986)
**Thermal Conductivity**
Thermal conductivity measurements of insulators for fusion blankets, 6:33498 (BNL—29779)

**CARBON 11**
**Tracer Techniques**
Toxicokinetic studies possible after acute inhalation administration of compounds labeled with short-lived isotopes, 6:33904 (CONF-800433—)

**CARBON 12**
**Isospin**
Measurements of isospin mixing between the $1^+$ doublet in $^{12}C$ using pion inelastic scattering, 6:34005

**CARBON 12 REACTIONS**
**Knock-Out Reactions**
Two-proton correlation measurements in 800 and 400 MeV/nucleon heavy-ion reactions, 6:34008
**Total Cross Sections**
Energy dependence of nucleus-nucleus total cross sections, 6:34006

**CARBON 12 TARGET**
**Alpha Reactions**
Energy dependence of nucleus-nucleus total cross sections, 6:34006
**Carbon 12 Reactions**
Energy dependence of nucleus-nucleus total cross sections, 6:34006
Two-proton correlation measurements in 800 and 400 MeV/nucleon heavy-ion reactions, 6:34008
**Comparative Evaluations**
Comparison of pion and photon induced reactions on complex nuclei, 6:34001
**Compound-Nucleus Reactions**
Search for resonances in $^{12}C(^{9}Be,\alpha)^{17}O$, 6:34003
**Deuteron Reactions**
Energy dependence of nucleus-nucleus total cross sections, 6:34006
**Helium 3 Reactions**
Energy dependence of nucleus-nucleus total cross sections, 6:34006

**Knock-Out Reactions**
Corrections to the closure approximation for the pion-nucleon t-matrix inside the nucleus, 6:34004
**Photonuclear Reactions**
Comparison of pion and photon induced reactions on complex nuclei, 6:34001
**Pion Reactions**
Corrections to the closure approximation for the pion-nucleon t-matrix inside the nucleus, 6:34004
Measurements of isospin mixing between the $1^+$ doublet in $^{12}C$ using pion inelastic scattering, 6:34005
**Proton Reactions**
Energy dependence of nucleus-nucleus total cross sections, 6:34006
Inclusive proton spectra and total reaction cross sections for proton-nucleus scattering at 800 MeV, 6:33997 (LA—8937-T)

**CARBON 13**
**Hypernuclei**
Experimental study of the sigma-nucleon system through the reaction d(K,$\pi$)SIGMA N. Progress report, January 1, 1981-December 31, 1981, 6:33967 (DOE/ER/04195—5)

**CARBON 13 TARGET**
**Electron Reactions**
Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)

**CARBON 14 REACTIONS**
**Elastic Scattering**
Gross structure and resonant behavior of $^{14}C + {}^{14}C$ elastic scattering, 6:34007

**CARBON 14 TARGET**
**Carbon 14 Reactions**
Gross structure and resonant behavior of $^{14}C + {}^{14}C$ elastic scattering, 6:34007
**Electron Reactions**
Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)

**CARBON BLACK**
**Correlations**
Relation between concentrations of polynuclear aromatic hydrocarbons and black carbon, 6:33757 (LBL—11986)

**CARBON DIOXIDE**
Impact of climate and energy, and the $CO_2$ problem, 6:33275
**Environmental Impacts**
$CO_2$ and acid rain, 6:33764

**CARBON DIOXIDE LASERS**
**Beam Transport**
Phase aberrations and beam cleanup techniques in carbon-dioxide laser fusion systems, 6:34178 (LA-UR—81-2523)
**Design**
Fusion power plant laser driver system, 6:34112 (CONF-801011—(Vol.2))
**Optical Systems**
Use of Zernike polynomials and interferometry in the optical design and assembly of large carbon-dioxide laser systems, 6:34179 (LA-UR—81-2524)
**Oscillators**
Three-electrode low pressure discharge apparatus and method for uniform ionization of gaseous media (Patent; $CO_2$ laser oscillator and pulse smoother), 6:33652
**Pulse Techniques**
Picosecond high-power switching at the Los Alamos National Laboratory, 6:33698 (LA—8720)
**Research Programs**
Inertial fusion program, January 1-June 30, 1979, 6:34175 (LA—8114-PR)
**Streak Photography**
Picosecond high-power switching at the Los Alamos National Laboratory, 6:33698 (LA—8720)

**CARBON MONOXIDE**
**Chemical Reactions**
Mechanistic studies of carbon monoxide reduction. Progress report, August 1, 1980-August 1, 1981, 6:33080 (DOE/ER/10345—2)
**Monitoring**
MAP3S/RAINE emissions inventory. Progress report, December 1980, 6:33725 (BNL—51378)
**Oxidation**
Diffusion and reaction in a stagnant boundary layer about a carbon particle--6. effect of water vapor on the pseudo-steady-state structure, 6:32847
**Reduction**
Mechanistic studies of carbon monoxide reduction. Progress report, August 1, 1980-August 1, 1981, 6:33080 (DOE/ER/10345—2)

**CARBON STEELS**
**Impact Shock**
Fracturing of simulated high-level waste glass in canisters, 6:33041 (PNL—3948)
**Thermal Stresses**
Fracturing of simulated high-level waste glass in canisters, 6:33041 (PNL—3948)

**CARBONACEOUS MATERIALS**
*See also COAL*
**Chemical Reactions**
Surface science of heterogeneous catalysis: possible applications in atmospheric sciences, 6:33590 (LBL—12986)

**CARBONYLS**
**Chemical Reactions**
Mechanistic studies of carbon monoxide reduction. Progress report, August 1, 1980-August 1, 1981, 6:33080 (DOE/ER/10345—2)
**Structural Chemical Analysis**
Mechanistic studies of carbon monoxide reduction. Progress report, August 1, 1980-August 1, 1981, 6:33080 (DOE/ER/10345—2)

**CARCINOGENESIS**
**Age Dependence**
Experimental radiation carcinogenesis: what have we learned ($^{60}Co$; fission neutrons; mice), 6:33895
**Radioinduction**
Experimental radiation carcinogenesis: what have we learned ($^{60}Co$; fission neutrons; mice), 6:33895

**CARCINOMAS**
**Diagnosis**
Distribution pattern of small and trace elements in human cancerous tissues and normal human tissues, 6:33878 (CONF-800433—)
**Multi-Element Analysis**
Distribution pattern of small and trace elements in human cancerous tissues and normal human tissues, 6:33878 (CONF-800433—)

**CARDIOVASCULAR DISEASES**
**Diagnosis**
Myocardial perfusion scintigraphy using a new technique, the mesh chamber. Progress report, September 1, 1978-May 1, 1981, 6:33689 (DOE/EV/04969—3)

**CATALYSIS**
**Chemical Reaction Kinetics**
Kinetics of the removal of iron pyrite from coal by microbial catalysis, 6:33871

**CATALYSTS**
*See also ELECTROCATALYSTS*
**Chemical Preparation**
Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1980, 6:32814 (DOE/ET/14700—2)
**Deactivation**
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1980, 6:32814 (DOE/ET/14700—2)
**Evaluation**
Exploratory study of coal-conversion chemistry. Quarterly report No. 9, March 20, 1980-June 19, 1980, 6:32816 (DOE/ET/14855—9)

Exploratory study of coal-conversion chemistry. Quarterly report, June 20, 1980-September 19, 1980, 6:32817 (DOE/ET/14855—12)
**Surface Properties**
Surface science of heterogeneous catalysis: possible applications in atmospheric sciences, 6:33590 (LBL—12986)
**Testing**
Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)
**CATECHOLAMINES**
**Radiopharmaceuticals**
Tricatecholamide analogs of enterobactin as gallium- and indium-binding radiopharmaceuticals, 6:33623
**CAVES**
**Seismic Effects**
Importance of joint parameters on deformations observed in dynamically loaded models of large excavations, 6:33926 (DPST—81-262)
**CAVITY RECEIVERS**
**Mathematical Models**
Solar radiation flux distributions in cavity receivers, 6:33142 (DOE/ET/21015—9)
**Solar Flux**
Solar radiation flux distributions in cavity receivers, 6:33142 (DOE/ET/21015—9)
**CE ENTRAINED FUEL PROCESS**
Surface Coal Gasification, 6:32819 (DOE/METC/SP—110)
**CELL CYCLE**
**Recessive Mutations**
Endomitotic effect of a cell cycle mutation of Saccharomyces cerevisiae, 6:33860
**CELL KILLING**
**In Vivo**
Cytotoxic reactions of free radical species of oxygen, 6:33852
**CELL MEMBRANES**
**Biochemical Reaction Kinetics**
Gradient coupling in isolated intestinal cells, 6:33853
**Biological Repair**
Cytoplasmic membrane fraction that promotes septation in an Escherichia coli lon mutant, 6:33898
**Photochemical Reactions**
Membrane oxidative damage, 6:33854 (LBL—11986)
**Quantitative Chemical Analysis**
Cytoplasmic membrane fraction that promotes septation in an Escherichia coli lon mutant, 6:33898
**CELLS (ANIMAL)**
*See ANIMAL CELLS*
**CELLS (BACTERIAL)**
*See BACTERIA*
**CELLULOSE**
**Biodegradation**
Degradation of softwood, hardwood, and grass lignocelluloses by two Steptomyces strains, 6:33872
**CENTRAL HEATING PLANTS**
*See also DISTRICT HEATING*
**Evaluation**
Potential opportunities for revitalization of the Rochester, New York steam district heating system, 6:33479 (ORNL/TM—7757)
**CENTRAL RECEIVER TEST FACILITY**
**Design**
5-Megawatt solar-thermal test facility, 6:33141 (CONF-7508108—1)
**Meetings**
5-Megawatt solar-thermal test facility, 6:33141 (CONF-7508108—1)
**CENTRAL RECEIVERS**
**Heat Storage**
Corrosion of Fe alloys in NaNo/sub 3/-KNO/sub 3/-NaNO/sub 2/ at 823 K, 6:33148
**CEPHEIDS**
**Pulsations**
Nonlinear calculations for BL Her stars, 6:33942
**Star Models**
Full amplitude models of 15 day Cepheids, 6:33933
**CERAMICS**
**Decomposition**
Analysis of potential attack on insulating materials exposed to sodium. Final report, 6:33306 (EPRI-NP—1986)
**Erosion**
Controlled combustion of a varying low-btu coal-derived gas, 6:32952
**Fracture Properties**
Toughening in glass ceramics through microstructural design, 6:33550 (SAND—81-0064C)
**Mechanical Properties**
Role of engineering judgement and the computer in the management of material property data, 6:33495 (CONF-800804—43)
**Microstructure**
Toughening in glass ceramics through microstructural design, 6:33550 (SAND—81-0064C)
**Phase Transformations**
Toughening in glass ceramics through microstructural design, 6:33550 (SAND—81-0064C)
**Physical Properties**
Role of engineering judgement and the computer in the management of material property data, 6:33495 (CONF-800804—43)
**Physical Radiation Effects**
Structural damage from fission fragment irradiation in crystalline nuclear waste phases, 6:33022 (DOE/ET/41900—5)
**Research Programs**
Metals and Ceramics Division materials science program. Annual progress report for period ending June 30, 1981, 6:33529 (ORNL/TM—7970)
Research in materials. Annual report, 6:33497
**Surface Treatments**
Manganese glass-molybdenum metallized and copper brazed 99.5% alumina ceramics, 6:33549 (MLM—2850)
**CERIUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Superconductivity**
Hill plots and americium, 6:34048

**CERIUM 142**
**Energy Levels**
Angular-correlation and coincidence studies of excited $0^+$ and other levels in the transitional Ce nuclides $^{142}Ce$, $^{144}Ce$, $^{146}Ce$ and $^{148}Ce$, 6:34017 (BNL—29690)
**CERIUM 144**
**Energy Levels**
Angular-correlation and coincidence studies of excited $0^+$ and other levels in the transitional Ce nuclides $^{142}Ce$, $^{144}Ce$, $^{146}Ce$ and $^{148}Ce$, 6:34017 (BNL—29690)
**CERIUM 146**
**Energy Levels**
Angular-correlation and coincidence studies of excited $0^+$ and other levels in the transitional Ce nuclides $^{142}Ce$, $^{144}Ce$, $^{146}Ce$ and $^{148}Ce$, 6:34017 (BNL—29690)
**CERIUM 148**
**Energy Levels**
Angular-correlation and coincidence studies of excited $0^+$ and other levels in the transitional Ce nuclides $^{142}Ce$, $^{144}Ce$, $^{146}Ce$ and $^{148}Ce$, 6:34017 (BNL—29690)
**CESIUM**
**Thermal Diffusivity**
Cesium thermomigration and reaction in nuclear fuels, 6:33313
**CESIUM 137**
**Radiation Monitoring**
Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)
**Radioecological Concentration**
Factors affecting radionuclide availability to vegetables grown at Los Alamos, 6:33903
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)
**Removal**
Effects of high radiation doses on Linde Ion Siv IE-95, 6:33028 (DP-MS—81-18)
**CETACEANS**
**Bibliographies**
Marine mammals of Hawaii: a bibliography, 6:33830 (LBL—13192)
Marine mammals of Puerto Rico: a bibliography, 6:33831 (LBL—13193)
**CHALKS**
*See LIMESTONE*
**CHARGED-PARTICLE ACTIVATION**
*See ACTIVATION ANALYSIS*
**CHARGED-PARTICLE REACTIONS**
*See also ALPHA REACTIONS*
*DEUTERON REACTIONS*
*ELECTRON REACTIONS*
*HEAVY ION REACTIONS*
*PROTON REACTIONS*
*TRITON REACTIONS*
**Elastic Scattering**
Intermediate energy proton and light-ion scattering, 6:33995 (LA-UR—81-2410)
**Inelastic Scattering**
Intermediate energy proton and light-ion scattering, 6:33995 (LA-UR—81-2410)
**CHARGED-PARTICLE TRANSPORT**
*(For diffusion or transmission of charged particles in material media.)*
**Computer Codes**
Monte Carlo computer program for the transport of energetic ions in amorphous targets, 6:34041
**CHARMED MESON RESONANCES**
*See also F*RESONANCES*
**Weak Hadronic Decay**
Soft-gluon effects in nonleptonic decays of charmed mesons, 6:33975
**CHARMONIUM**
**Spectroscopy**
Quarkonium spectroscopy, 6:33970 (SLAC-PUB—2761)
**CHELATING AGENTS**
**Radiopharmaceuticals**
Tricatecholamide analogs of enterobactin as gallium- and indium-binding radiopharmaceuticals, 6:33623
**CHEMICAL ANALYSIS**
*See also ABSORPTION SPECTROSCOPY*
*ACTIVATION ANALYSIS*
*ELECTRON MICROPROBE ANALYSIS*
*FLUORESCENCE SPECTROSCOPY*
*GAMMA SPECTROSCOPY*
*LASER SPECTROSCOPY*
*MULTI-ELEMENT ANALYSIS*
*NUCLEAR REACTION ANALYSIS*
*QUANTITATIVE CHEMICAL ANALYSIS*
*X-RAY EMISSION ANALYSIS*
*X-RAY FLUORESCENCE ANALYSIS*
**Meetings**
Nuclear methods in environmental and energy research, 6:33784 (CONF-800433—)
**Reviews**
Hy-phen-ated methods (Combined methods, such as gas chromatography-mass spectroscopy), 6:33585
**CHEMICAL COMPOSITION**
**Variations**
Variation of minor and trace elements in coals from unknown geologic settings, 6:33782 (CONF-800433—)
**CHEMICAL EFFLUENTS**
**Ground Disposal**
Soil homogeneity evaluation by radionuclide tracer breakthrough curve interpretation, 6:33819 (CONF-800433—)
**Multi-Element Analysis**
Development of novel radiochromatographic techniques for investigation of trace element behavior in coal liquefaction, 6:33825 (CONF-800433—)
Studies of Oxygen and Nitrogen in coal conversion liquids by 14 MeV INAA, 6:33816 (CONF-800433—)
**CHEMICAL EXPLOSIONS**
**Pressure Measurement**
Reaction rates from pressure-gauge measurements in reacting explosives, 6:33710 (LA-UR—81-2482)
**Reaction Kinetics**
Reaction rates from pressure-gauge measurements in reacting explosives, 6:33710 (LA-UR—81-2482)
**CHEMICAL EXPLOSIVES**
*See also NITROMETHANE*
*PETN*
*TATB*
*TNT*
**Combustion Products**
High-explosive detonations in varying-oxygen atmospheres (PBX 9404 and TNT), 6:33716 (UCRL—86563)
**Detection**
Evaluation of active and passive near-millimeter-wave radiometric imaging techniques for detection of concealed objects, 6:33062 (SAND—81-1051)
**Detonations**
Free-surface velocity measurements of plates driven by reacting and detonating RX-03-BB and PBX-0404, 6:33715 (UCRL—86372)
Global kinetics for the shock-induced decomposition of heterogeneous explosives, 6:33709 (LA-UR—81-1835)
High-explosive detonations in varying-oxygen atmospheres (PBX 9404 and TNT), 6:33716 (UCRL—86563)
Reaction rates from pressure-gauge measurements in reacting explosives, 6:33710 (LA-UR—81-2482)
**Detonators**
Deflagration-to-detonation transition (DDT) project. Semiannual report, June-November 1980, 6:33713 (SAND—81-0937)
**Fireballs**
High-explosive detonations in varying-oxygen atmospheres (PBX 9404 and TNT), 6:33716 (UCRL—86563)
**Ignition**
Computer modeling of an all-secondary explosive hot-wire device, 6:33708 (LA—8930-MS)
**Impact Shock**
Global kinetics for the shock-induced decomposition of heterogeneous explosives, 6:33709 (LA-UR—81-1835)
**CHEMICAL INDUSTRY**
**Energy Consumption**
Determination of specific consumption of raw materials and energy in the chemical industry, 6:33472

**CHEMICAL REACTORS**
**Design**
Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)
**Performance Testing**
Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)
**CHEMISTRY**
*See also ATMOSPHERIC CHEMISTRY*
*ELECTROCHEMISTRY*
*NUCLEAR CHEMISTRY*
*PHOTOCHEMISTRY*
**Research Programs**
Fundamental interactions, 6:33569 (LBL—12000)
**CHINA**
**Natural Gas Deposits**
Mechanism of the formation of diapiric structural traps in Dongying depression, Shandong, 6:32962
**Petroleum Deposits**
Discussions on the main periods and threshold temperature (depth) of oilgeneration in the Songliao basin, 6:32966
Mechanism of the formation of diapiric structural traps in Dongying depression, Shandong, 6:32962
Occurrence of the oil pool in the metamorphosed basement in Yaerxia in the western part of the Jiuquan Basin, 6:32963
Occurrence of oil in the complex fault-blocks in the Jiyang sag, 6:32965
Source of oil for the western part of the Tarimu Basin, 6:32964
**CHLORAMINE-B**
*See CHLORAMINES*
**CHLORAMINES**
**Toxicity**
Comparative toxicity of hypochlorous acid and hypochlorite ions to mosquitofish, 6:33915
**CHLORAMINE-T**
*See CHLORAMINES*
**CHLORATES**
**Chemical Reactions**
Rate of reaction of superoxide radical with chloride-containing species, 6:33598
**CHLORIDES**
**Chemical Reactions**
Rate of reaction of superoxide radical with chloride-containing species, 6:33598
**CHLORINE**
**Toxicity**
Studies on toxicity of OTEC plant components on marine animals from the Gulf of Mexico. Final report, September 1, 1978-November 30, 1980, 6:33909 (DOE/ET/20512—T1)
**CHLORINE 35 TARGET**
**Argon 40 Reactions**
Two-proton correlation measurements in 800 and 400 MeV/nucleon heavy-ion reactions, 6:34008
**CHLORINE COMPOUNDS**
**Toxicity**
Comparative toxicity of hypochlorous acid and hypochlorite ions to mosquitofish, 6:33915
**CHLORINE LOGS**
*See NEUTRON-GAMMA LOGGING*
**CHLOROPHYLL**
**Electronic Structure**
Stereoelectronic properties of photosynthetic and related systems. 10. Quantum mechanical characterization of the excited states of ethyl chlorophyllide α enol, 6:33609
**CHLOROUS ACID**
**Chemical Reactions**
Rate of reaction of superoxide radical with chloride-containing species, 6:33598
**CHROMIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Mass Spectroscopy**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
**CHROMIUM 52 TARGET**
**Pion Minus Reactions**
Comparison of $\pi^+$ and $\pi^-$ elastic and inelastic scattering from $^{52}$Cr at 180 MeV, 6:34014
**Pion Plus Reactions**
Comparison of $\pi^+$ and $\pi^-$ elastic and inelastic scattering from $^{52}$Cr at 180 MeV, 6:34014
**CHROMIUM ALLOYS**
*See also CHROMIUM STEELS*
*CHROMIUM-NICKEL STEELS*
**Diffusion**
Zero-flux planes and flux reversals in multicomponent diffusion. Progress report, January 1, 1981-August 31, 1981 (Cu-Ni-Zn; Fe-Ni-Cr), 6:33508 (DOE/ER/10814—1)
**Pitting Corrosion**
Investigation of high temperature corrosion of Ni-Cr alloy by the burning hydrocarbons, 6:33662
**CHROMIUM STEELS**
*(Steels containing only chromium as alloying element; see also CHROMIUM-NICKEL STEELS.)*
**Microstructure**
Microstructural examination of several commercial ferritic alloys irradiated to high fluence, 6:33512 (HEDL-SA—2338-FP)
**Physical Radiation Effects**
Microstructural examination of several commercial ferritic alloys irradiated to high fluence, 6:33512 (HEDL-SA—2338-FP)
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
**Swelling**
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
**CHROMIUM-MOLYBDENUM STEELS**
**Heat Treatments**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**Weldability**
Measurement of strain across a transition joint interface using Moire fringes (Between 2 1/4 Cr-1 Mo and 316 ss pipes.), 6:33325 (R/M/N—1068)
**Welded Joints**
Interfacial structures in nickel-based transition joints after long term service (From Ratcliffe Power Station), 6:33266 (RD/M/N—1131)
**CHROMIUM-NICKEL STEELS**
*(Steels containing Cr and Ni; the Ni content is usually 0.5 to 2.0%, the Cr content is higher.)*
**Embrittlement**
Preirradiation microstructrual development designed to minimize properties degradation during irradiation in austentic alloys, 6:33505 (CONF-810831—11)

**Physical Radiation Effects**
Preirradiation microstructrual development designed to minimize properties degradation during irradiation in austentic alloys, 6:33505 (CONF-810831—11)
**Swelling**
Preirradiation microstructrual development designed to minimize properties degradation during irradiation in austentic alloys, 6:33505 (CONF-810831—11)
**CHROMODYNAMICS**
*See QUANTUM CHROMODYNAMICS*
**CLAMS**
*See MOLLUSCS*
**CLEAN AIR ACT**
**Implementation**
Impacts of Federal clean air law on district-heating opportunities, 6:33770 (BNL—51389)
**CLINCH RIVER BREEDER REACTOR**
Contribution of Clinch River Breeder Reactor plant design and development to the LMFBR fuel cycle, 6:33302 (CONF-810941—1)
**CLINTON P ANDERSON MESON PHY. FACILITY**
*See LAMPF LINAC*
**CLONE CELLS**
**Cell Differentiation**
Unstable cellular differentiation in adenosquamous cell carcinoma, 6:33856
**COAL**
*See also SOLVENT-REFINED COAL*
**Activation Analysis**
Assessments of accuracy and precision of multi-element determinations in whole coal by non-destructive neutron activation analysis, 6:33778 (CONF-800433—)
Coal blending by continuous nuclear assay, 6:32932 (EPRI-WS—79-236)
Instrumental prompt gamma activation analysis of energy-related samples and standards, 6:33777 (CONF-800433—)
**Chemical Composition**
Classification of coal by trace analysis using INAA-clusteranalysis and leaching of precipitator ash, 6:33780 (CONF-800433—)
Determination of mineral matter in coal by target transformation factor analysis, 6:33783 (CONF-800433—)
**Chemical Reactions**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**Cocombustion**
Cofiring of refuse-derived fuel and coal at Oak Creek. Volume 1. Boiler corrosion evaluation. Final report, 6:33088 (EPRI-CS—1983-Vol.1)
**Combustion**
CaO interactions in the staged combustion of coal. Third quarterly technical progress report, April 1, 1981-June 30, 1981 (Reaction with $FeS_2$ and with sulfur), 6:32946 (DOE/PC/30301—3)
Improved particle trajectory calculations through turbomachinery affected by coal ash particles, 6:32943
Kinetics of NO/sub x/ formation during early stages of pulversized-coal combustion. Third quarterly report, 4 April 1981-30 June 1981, 6:32945 (DOE/PC/30295—3)
Measurement of fundamental properties characterizing coal minerals and fireside deposits. First quarterly technical progress report, 1 April 1981-30 June 1981, 6:32859 (DOE/PC/40266—1)
**Combustion Products**
Fundamentals of nitric oxide formation in fossil-fuel combustion. Progress report, 29 September-28 December 1980, 6:32944 (DOE/ET/10593—T2)
**Compacting**
Chemical crusting of coal stockpiles for the control of fugitive dust, water erosion, water penetration and spontaneous firing, 6:32939 (EPRI-WS—79-236)
**Compression Strength**
Results of some index tests on coal at Cook Colliery, Queensland Coal Mining Company, Blackwater, Queensland, 6:32863
**Crushing**
Investigation of novel coal-preparation techniques (Wet), 6:32941
**Desulfurization**
CaO interactions in the staged combustion of coal. Third quarterly technical progress report, April 1, 1981-June 30, 1981 (Reaction with $FeS_2$ and with sulfur), 6:32946 (DOE/PC/30301—3)
Kinetics of oxydesulfurization of Upper Freeport coal, 6:32838
Kinetics of the removal of iron pyrite from coal by microbial catalysis, 6:33871
Preliminary study: use of low-sulfur coal and coal cleaning in control of acid rain, 6:32866 (DOE/MC/14784—T1)
**Electrolysis**
Electrochemical gasification of coal--simultaneous production of hydrogen and carbon dioxide by a single reaction involving coal, water, and electrons, 6:32850
**Electron Microscopy**
Fossil energy, 6:32862 (LBL—12000)
**Fluidized-Bed Combustion**
Coal and limestone feed testing for atmospheric fluidized bed combustion, 6:32948 (ORNL/TM—7724)
Hydration enhanced sulfation of limestone and dolomite in the fluidized-bed combustion of coal, 6:32954
Tennessee Valley Authority atmospheric fluidized-bed combustor simulation interim annual report, January 1-December 31, 1980, 6:33265 (ORNL/TM—7847)
**Fracture Properties**
Results of some index tests on coal at Cook Colliery, Queensland Coal Mining Company, Blackwater, Queensland, 6:32863
**Freeze Protection**
Solving coal flow problems at Detroit Edison Company, 6:32929 (EPRI-WS—79-236)
Total program approach to freeze conditioning: experiences of Toledo Edison, 6:32937 (EPRI-WS—79-236)
**Freezing**
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)
Discussion: measuring the effectiveness of FCA, 6:32928 (EPRI-WS—79-236)
Solving coal flow problems at Detroit Edison Company, 6:32929 (EPRI-WS—79-236)
Total program approach to freeze conditioning: experiences of Toledo Edison, 6:32937 (EPRI-WS—79-236)
**Fuel Additives**
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)
Reducing the frozen coal problem to manageable proportions (With treatment costs of $9000 per train, treatment is applied only when sufficiently cold weather is forecast), 6:32938 (EPRI-WS—79-236)
**Fuel Feeding Systems**
Feeding coal into a pulverizer at Monsanto's Soda Springs plant, 6:32926 (EPRI-WS—79-236)
**Grain Density**
Results of some index tests on coal at Cook Colliery, Queensland Coal Mining Company, Blackwater, Queensland, 6:32863
**Hydrogenation**
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, October-December 1979, 6:32813 (DOE/ET/14700—1)
Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Annual progress report, February 1980-February 1981, 6:32834 (DOE/PC/30080—4)
**Maritime Transport**
Effects of ice on coal movement via the inland waterways. Special report 81-13, 6:33404 (DOE/ET/14356—T1)
**Materials Handling**
Central station dust control for coal handling equipment, 6:32940 (EPRI-WS—79-236)
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)
Coal and ash handling in a typical industrial boiler plant, 6:33647

Coal handling in freezing weather present state-of-the-art and research needs, 6:32936 (EPRI-WS—79-236)
Control of the fugitive dust during the loading of trucks with western coal fly ash, 6:32894 (EPRI-WS—79-236)
Estimating the equivalent availability of a coal handling system, 6:32930 (EPRI-WS—79-236)
Evaluation of coal blending systems (Blending to control $SO_2$ and equipment efficiency), 6:32933 (EPRI-WS—79-236)
Feeding coal into a pulverizer at Monsanto's Soda Springs plant, 6:32926 (EPRI-WS—79-236)
In-plant coal handling, 6:32934 (EPRI-WS—79-236)
Solving coal flow problems at Detroit Edison Company, 6:32929 (EPRI-WS—79-236)

**Meetings**
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)

**Mixing**
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)
Coal blending by continuous nuclear assay, 6:32932 (EPRI-WS—79-236)
Coal storage study, 6:32823 (DOE/OR/03054—3)
Evaluation of coal blending systems (Blending to control $SO_2$ and equipment efficiency), 6:32933 (EPRI-WS—79-236)

**Multi-Element Analysis**
Instrumental prompt gamma activation analysis of energy-related samples and standards, 6:33777 (CONF-800433—)
Nuclear methods in coal research, 6:33776 (CONF-800433—)
Nuclear techniques for the on-line bulk analysis of coal, 6:33781 (CONF-800433—)
Use of neutron-capture prompt gamma-ray activation analysis in environmental and energy research, 6:33806 (CONF-800433—)
Variation of minor and trace elements in coals from unknown geologic settings, 6:33782 (CONF-800433—)

**Oxidation**
Investigation of novel coal-preparation techniques (Wet), 6:32941
Study of coal oxidation by charged particle activation analysis, 6:33779 (CONF-800433—)

**Porosity**
Results of some index tests on coal at Cook Colliery, Queensland Coal Mining Company, Blackwater, Queensland, 6:32863

**Quantitative Chemical Analysis**
Variation of minor and trace elements in coals from unknown geologic settings, 6:33782 (CONF-800433—)

**Sampling**
Coal handling is more than material handling, 6:32931 (EPRI-WS—79-236)

**Solvent Extraction**
Investigation of novel coal-preparation techniques (Wet), 6:32941

**Stockpiles**
Chemical crusting of coal stockpiles for the control of fugitive dust, water erosion, water penetration and spontaneous firing, 6:32939 (EPRI-WS—79-236)
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)
Coal and ash handling in a typical industrial boiler plant, 6:33647

**Storage**
Coal and ash handling in a typical industrial boiler plant, 6:33647
Coal handling is more than material handling, 6:32931 (EPRI-WS—79-236)
Coal storage study, 6:32823 (DOE/OR/03054—3)
Control of the fugitive dust during the loading of trucks with western coal fly ash, 6:32894 (EPRI-WS—79-236)
In-plant coal handling, 6:32934 (EPRI-WS—79-236)
Solving coal flow problems at Detroit Edison Company, 6:32929 (EPRI-WS—79-236)

**Structural Chemical Analysis**
Fossil energy, 6:32862 (LBL—12000)
Statistical coal structure analysis cross polarization/magic angle spinning (CP/MAS)-$^{13}$C-NMR spectroscopy: quantitative evaluation of aromaticity parameters, 6:32857 (CONF-810914—5)

**Sulfur Content**
Preliminary study: use of low-sulfur coal and coal cleaning in control of acid rain, 6:32866 (DOE/MC/14784—T1)

**Supercritical Gas Extraction**
Investigation of novel coal-preparation techniques (Wet), 6:32941

**Supply and Demand**
Basic facts about Colorado's energy resources and reserves, 6:33386

**Surface Properties**
Coal and limestone feed testing for atmospheric fluidized bed combustion, 6:32948 (ORNL/TM—7724)

**Technology Assessment**
Technology characterizations: environmental information handbook. Second edition, 6:33840 (DOE/EP—0028)

**Transport**
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)
Coal and ash handling in a typical industrial boiler plant, 6:33647
Coal handling in freezing weather present state-of-the-art and research needs, 6:32936 (EPRI-WS—79-236)
Coal storage study, 6:32823 (DOE/OR/03054—3)
Discussion: measuring the effectiveness of FCA, 6:32928 (EPRI-WS—79-236)
Examination of potential transportation impediments to the movement of coal, 6:32923 (DOE/ET/15299—T1)
Reducing the frozen coal problem to manageable proportions (With treatment costs of $9000 per train, treatment is applied only when sufficiently cold weather is forecast), 6:32938 (EPRI-WS—79-236)
Solving coal flow problems at Detroit Edison Company, 6:32929 (EPRI-WS—79-236)
Total program approach to freeze conditioning: experiences of Toledo Edison, 6:32937 (EPRI-WS—79-236)

**Washing**
Analyses of the Pittsburgh coal seam from a northern West Virginia preparation plant, 6:32864

**COAL DEPOSITS**

**Exploration**
Exploration of coal and anthracitic carbonaceous shale resources, Narragansett Basin, Massachusetts and Rhode Island. Final report, 1 October 1979-30 April 1981, 6:32899 (DOE/RA/20029—T1)

**Resource Assessment**
Exploration of coal and anthracitic carbonaceous shale resources, Narragansett Basin, Massachusetts and Rhode Island. Final report, 1 October 1979-30 April 1981, 6:32899 (DOE/RA/20029—T1)

**COAL FINES**

**Combustion Products**
New approach for erosion prediction due to fly ash, 6:33267

**Flocculation**
Removal and recovery of fine size coal from coal preparation plant waters. Report No. 1: January 1, 1977-December 31, 1977, 6:32924 (DOE/TIC—11482)

**Recovery**
Removal and recovery of fine size coal from coal preparation plant waters. Report No. 1: January 1, 1977-December 31, 1977, 6:32924 (DOE/TIC—11482)

**Separation Processes**
Removal and recovery of fine size coal from coal preparation plant waters. Report No. 1: January 1, 1977-December 31, 1977, 6:32924 (DOE/TIC—11482)

**COAL GAS**

**Cocombustion**
Feasibility and economic study of medium-Btu coal gas blended with high-Btu by-product gas as an industrial energy source at Billings, Montana. Final report, 6:33082 (DOE/FE/20219—2)

**COAL GASIFICATION**

*See also BI-GAS PROCESS*
*CE ENTRAINED FUEL PROCESS*
*EXXON GASIFICATION PROCESS*
*FLASH HYDROPYROLYSIS PROCESS*
*IN-SITU GASIFICATION*

*KOPPERS-TOTZEK PROCESS*
*LURGI PROCESS*
*LURGI SLAGGING PROCESS*
*WESTINGHOUSE GASIFICATION PROCESS*
*WINKLER PROCESS*
Controlled combustion of a varying low-btu coal-derived gas, 6:32952
Environmental R and D needs for advanced power plants, 6:32895
Processes and techniques, 6:32839 (LBL—12000)

**Aerosols**
Low-Btu-gasifier emissions toxicology. Status report, December 1980, 6:32960 (LMF—85)

**Commercialization**
Advanced-gasification processes, 6:32820 (DOE/METC/SP—183)

**Computerized Simulation**
Dynamic simulation of methanation reactors, interstage heat exchangers, and controllers, 6:32852

**Economics**
Economics of synfuel and gasification systems, 6:32959

**Evaluation**
Electrochemical gasification of coal--simultaneous production of hydrogen and carbon dioxide by a single reaction involving coal, water, and electrons, 6:32850

**Gas Analysis**
Continuous analyzer system for in-situ coal gasification project, 6:32854

**Mathematical Models**
One-dimensional model for pulverized coal combustion and gasification, 6:32837

**Process Development Units**
High-mass-flux coal gasifier. Final report, Phase III (Bill high mom flux), 6:32812 (DOE/ET/14674—16)

**Reviews**
Advanced-gasification processes, 6:32820 (DOE/METC/SP—183)
Surface Coal Gasification, 6:32819 (DOE/METC/SP—110)

**Simulation**
Simulation of coal conversion reactor environments, 6:32851

**COAL GASIFICATION PLANTS**

**Construction**
Pipeline-gas demonstration plant: Phase I. Construction planning. Volume 1: safety procedures, temporary facilities, and labor survey, 6:32856 (DOE/ET/13060—T9(Vol.2))

**Corrosion**
Sulfidation resistance of high-temperature alloys tested in reducing and oxidizing atmospheres, 6:32840

**Economic Analysis**
Feasibility and economic study of medium-Btu coal gas blended with high-Btu by-product gas as an industrial energy source at Billings, Montana. Final report, 6:33082 (DOE/FE/20219—2)

**Economics**
Low/medium-Btu coal-gasification assessment of central plant for the city of Philadelphia, Pennsylvania, 6:32836 (DOE/RA/20222—2)

**Environmental Impacts**
Pipeline-gas demonstration plant: Phase I. Construction planning. Volume 1: safety procedures, temporary facilities, and labor survey, 6:32856 (DOE/ET/13060—T9(Vol.2))

**Equipment**
Failure analysis of coal-gasification pilot plant components, 6:32855

**Failures**
Materials technology for coal-conversion processes. Progress report, January-March, 1981, 6:32804 (ANL—81-30)

**Feasibility Studies**
Feasibility and economic study of medium-Btu coal gas blended with high-Btu by-product gas as an industrial energy source at Billings, Montana. Final report, 6:33082 (DOE/FE/20219—2)

**Heat Sources**
Production of substitute natural gas by a fusion hybrid reactor coupled to a catalyzed coal gasification plant, 6:34125 (CONF-801011—(Vol.2))

**Materials**
Materials research for the clean utilization of coal. Quarterly progress report, April-June 1981, 6:32835 (DOE/PR/06010—T7)

**Materials Testing**
Materials technology for coal-conversion processes. Progress report, January-March, 1981, 6:32804 (ANL—81-30)
Sulfidation resistance of high-temperature alloys tested in reducing and oxidizing atmospheres, 6:32840

**Risk Assessment**
Low/medium-Btu coal-gasification assessment of central plant for the city of Philadelphia, Pennsylvania, 6:32836 (DOE/RA/20222—2)

**Safety Engineering**
Pipeline-gas demonstration plant: Phase I. Construction planning. Volume 1: safety procedures, temporary facilities, and labor survey, 6:32856 (DOE/ET/13060—T9(Vol.2))

**Site Selection**
Low/medium-Btu coal-gasification assessment of central plant for the city of Philadelphia, Pennsylvania, 6:32836 (DOE/RA/20222—2)

**COAL INDUSTRY**

**Solid Wastes**
Solid-waste impacts of increased coal utilization, 6:32865 (BNL—24786)

**Waste Management**
Solid-waste impacts of increased coal utilization, 6:32865 (BNL—24786)

**COAL LIQUEFACTION**

*See also FLASH HYDROPYROLYSIS PROCESS*
*SRC-II PROCESS*
Comparison of independent product cost estimates: the cost of methanol from coal, 6:32848
Processes and techniques, 6:32839 (LBL—12000)

**Catalysts**
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, October-December 1979, 6:32813 (DOE/ET/14700—1)
Exploratory study of coal-conversion chemistry. Quarterly report No. 9, March 20, 1980-June 19, 1980, 6:32816 (DOE/ET/14855—9)
Exploratory study of coal-conversion chemistry. Quarterly report, December 20, 1979-March 19, 1980, 6:32815 (DOE/ET/14855—6)
Exploratory study of coal-conversion chemistry. Quarterly report, June 20, 1980-September 19, 1980, 6:32817 (DOE/ET/14855—12)

**Chemical Effluents**
Development of novel radiochromatographic techniques for investigation of trace element behavior in coal liquefaction, 6:33825 (CONF-800433—)

**Chemical Reaction Kinetics**
Kinetics of coal liquefaction: effect of catalyst, H/sub 2/ concentration and coal type, 6:32849

**Chemistry**
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, October-December 1979, 6:32813 (DOE/ET/14700—1)
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1980, 6:32814 (DOE/ET/14700—2)
Coal structure cleavage mechanisms: scission of methylene and ether linkages to hydroxylated rings, 6:32844
Exploratory study of coal-conversion chemistry. Quarterly report No. 9, March 20, 1980-June 19, 1980, 6:32816 (DOE/ET/14855—9)
Exploratory study of coal-conversion chemistry. Quarterly report, December 20, 1979-March 19, 1980, 6:32815 (DOE/ET/14855—6)
Exploratory study of coal-conversion chemistry. Quarterly report, June 20, 1980-September 19, 1980, 6:32817 (DOE/ET/14855—12)
Fossil energy, 6:32862 (LBL—12000)
Thermolysis of naphthols, 6:32808 (CONF-810914—6)

**Health Hazards**
Critical review of the mutagenic and other genotoxic effects of direct coal liquefaction, 6:33912 (ORNL—5721)
**Hydrogen Transfer**
Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Annual progress report, February 1980-February 1981, 6:32834 (DOE/PC/30080—4)
**Research Programs**
Design properties of coal liquids: edited workshop proceedings, 6:32807 (CONF-810381—)
Exploratory study of coal-conversion chemistry. Quarterly report No. 9, March 20, 1980-June 19, 1980, 6:32816 (DOE/ET/14855—9)
Exploratory study of coal-conversion chemistry. Quarterly report, December 20, 1979-March 19, 1980, 6:32815 (DOE/ET/14855—6)
**Simulation**
Simulation of coal conversion reactor environments, 6:32851
**Solvents**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, April 1981-June 1981, 6:32833 (DOE/PC/30041—T6)
Thermolysis of naphthols, 6:32808 (CONF-810914—6)

**COAL LIQUEFACTION PLANTS**
**Design**
Failure modes and effects analysis of a coal-slurry preheater, 6:32841 (ORNL/TM—7664)
**Failure Mode Analysis**
Failure modes and effects analysis of a coal-slurry preheater, 6:32841 (ORNL/TM—7664)
**Heaters**
Failure modes and effects analysis of a coal-slurry preheater, 6:32841 (ORNL/TM—7664)
**Materials**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
Materials research for the clean utilization of coal. Quarterly progress report, April-June 1981, 6:32835 (DOE/PR/06010—T7)
**Materials Testing**
Fossil energy, 6:32862 (LBL—12000)
Materials technology for coal-conversion processes. Progress report, January-March, 1981, 6:32804 (ANL—81-30)
**Residues**
Ash concentrate conveying system, 6:32822 (DOE/OR/03054—3)

**COAL LIQUIDS**
**Boiling Points**
Development of SRC-1 product analysis, 6:32828 (DOE/OR/03054—3)
**Catalytic Cracking**
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, October-December 1979, 6:32813 (DOE/ET/14700—1)
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1980, 6:32814 (DOE/ET/14700—2)
**Chemical Analysis**
SRC-I Demonstration Plant analytical laboratory, 6:32829 (DOE/OR/03054—3)
**Chemical Composition**
Effects of components of synfuels on soot formation. Quarterly technical progress report Number 3, April 1-June 30, 1981, 6:32947 (DOE/PC/30307—3)
**Combustion**
Design and preliminary results of a fuel flexible industrial gas turbine combustor, 6:32950
Evaluation of concepts for controlling exhaust emissions from minimally processed petroleum and synthetic fuels, 6:32953
Low NO/sub x/ combustion systems for burning heavy residual fuels and high-fuel-bound nitrogen fuels, 6:32951
**Combustion Properties**
Effects of components of synfuels on soot formation. Quarterly technical progress report Number 3, April 1-June 30, 1981, 6:32947 (DOE/PC/30307—3)
**Comparative Evaluations**
Economics of enhanced oil recovery and its position relative to synfuels, 6:32976
**Corrosive Effects**
Effects of trace impurities in coal-derived liquid fuels on deposition and accelerated high-temperature corrosion of cast superalloys, 6:33509 (DOE/NASA/2593—22)
**Deactivation**
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, October-December 1979, 6:32813 (DOE/ET/14700—1)
**Deashing**
Ash concentrate conveying system, 6:32822 (DOE/OR/03054—3)
**Distillation**
Solvent-refined-coal (SRC) process. Quarterly technical progress report, July 1980-September 1980, 6:32809 (DOE/ET/10104—8)
**Fractionation**
Development of SRC-1 product analysis, 6:32828 (DOE/OR/03054—3)
**Gas Chromatography**
Development of SRC-1 product analysis, 6:32828 (DOE/OR/03054—3)
**Hydrogenation**
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, October-December 1979, 6:32813 (DOE/ET/14700—1)
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1980, 6:32814 (DOE/ET/14700—2)
High-conversion and low-conversion LC-finer runs, 6:32827 (DOE/OR/03054—3)
**LC-Fining**
High-conversion and low-conversion LC-finer runs, 6:32827 (DOE/OR/03054—3)
**Mutagenesis**
Critical review of the mutagenic and other genotoxic effects of direct coal liquefaction, 6:33912 (ORNL—5721)
**Performance Testing**
Solvent-refined-coal (SRC) process. Quarterly technical progress report, July 1980-September 1980, 6:32809 (DOE/ET/10104—8)
**Physical Properties**
Design properties of coal liquids: edited workshop proceedings, 6:32807 (CONF-810381—)
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
Solvent-refined-coal (SRC) process. Quarterly technical progress report, July 1980-September 1980, 6:32809 (DOE/ET/10104—8)
**Solvent Properties**
Solubility of hydrogen in coal liquids, 6:32830 (DOE/OR/03054—3)
**Thermodynamic Properties**
Design properties of coal liquids: edited workshop proceedings, 6:32807 (CONF-810381—)
**Toxicity**
Critical review of the mutagenic and other genotoxic effects of direct coal liquefaction, 6:33912 (ORNL—5721)

**COAL MINERS**
**Productivity**
Analysis of the labor productivity decline in the U.S. bituminous coal mining industry. Final technical report , 6:32906 (DOE/ET/10033—T2)

**COAL MINES**
**Computerized Simulation**
Northern Great Plains reclamation cost projections by computer, 6:32889 (ANL/LRP-TM—20)
**Land Reclamation**
Analysis of post-restoration agricultural management at the Iowa coal project demonstration mine, 6:32884 (ANL/LRP-TM—20)

Analytical overview of practices, costs, and interdisciplinary relationships and trade-offs for reclamation planning in the coal industry with applications to non-coal, 6:32888 (ANL/LRP-TM—20)
Costs of recontouring abandoned mined land, 6:32891 (ANL/LRP-TM—20)
Develop a winch-drawn dozer blade equipment system: modification A010-spoil-plane for leveling surface mine spoils. Semi-annual technical progress report, 6:32893 (DOE/ET/12394—T2)
Dragline reclamation of abandoned contour mines, 6:32890 (ANL/LRP-TM—20)
Economic considerations of reclaiming abandoned tailings ponds and dams, 6:32892 (ANL/LRP-TM—20)
Economics of reclamation, 6:32881 (ANL/LRP-TM—20)
Economics of surface mine reclamation, 6:32883 (ANL/LRP-TM—20)
Evaluation of the potential of alternative land use plans for surface mined land, 6:32887 (ANL/LRP-TM—20)
Northern Great Plains reclamation cost projections by computer, 6:32889 (ANL/LRP-TM—20)
Performance bonding impact upon the cost of reclamation of coal mines lands, 6:32956 (ANL/LRP-TM—20)
Proceedings: conference on the economics of mined-land reclamation, 6:32880 (ANL/LRP-TM—20)
Public myths about reclamation, 6:32882 (ANL/LRP-TM—20)
Reclamation in the big sky, 6:32957 (ANL/LRP-TM—20)
Reclamation versus land use transformation: a cost comparison, 6:32885 (ANL/LRP-TM—20)

**Permits**
Zoning lands unsuitable for surface coal mining: an economic review, 6:32955 (ANL/LRP-TM—20)

**Planning**
Analytical overview of practices, costs, and interdisciplinary relationships and trade-offs for reclamation planning in the coal industry with applications to non-coal, 6:32888 (ANL/LRP-TM—20)

**Rock Mechanics**
Role of geomechanics research in Australian coal mines, 6:32915

**Waste Management**
Solid-waste impacts of increased coal utilization, 6:32865 (BNL—24786)

**COAL MINING**
*See also CROSS-RIDGE MINING*
*LONGWALL MINING*
*SURFACE MINING*
*UNDERGROUND MINING*

**Drilling Equipment**
Development of two-phase flow and material-transport models for large-diameter drilling systems: program overview and preliminary results, 6:33636 (LA—8894-MS)

**Economic Analysis**
Analysis of the labor productivity decline in the U.S. bituminous coal mining industry. Final technical report , 6:32906 (DOE/ET/10033—T2)

**COAL PREPARATION**

**Bench-Scale Experiments**
Investigation of novel coal-preparation techniques, 6:32941

**Cost**
Preliminary study: use of low-sulfur coal and coal cleaning in control of acid rain, 6:32866 (DOE/MC/14784—T1)

**Magnetic Separators**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)

**COAL PREPARATION PLANTS**

**Waste Water**
Removal and recovery of fine size coal from coal preparation plant waters. Report No. 1: January 1, 1977-December 31, 1977, 6:32924 (DOE/TIC—11482)

**COAL PRODUCING DISTRICTS**

**Topography**
Initial mathematical modelling study of the relationship between underground working conditions and overlying surface topography with reference to the Western Coalfields, N.S.W., 6:32922

**COAL RESERVES**

**Resource Assessment**
Preliminary study: use of low-sulfur coal and coal cleaning in control of acid rain, 6:32866 (DOE/MC/14784—T1)

**COAL SEAMS**

**Chemical Analysis**
Analyses of the Pittsburgh coal seam from a northern West Virginia preparation plant, 6:32864

**Drill Cores**
Example of the use of point load testing and rock-quality designation, 6:32901

**Fractures**
Mathematical analysis of factors influencing the development of mining-induced fractures around blind-ended openings with particular reference to Leichhardt Colliery, 6:32858 (CSIRO—7)

**Geology**
Depositional environments in the Barabala Coal Measures: Moura, Queensland, 6:32914

**Rock Mechanics**
Example of the use of point load testing and rock-quality designation, 6:32901

**Stratigraphy**
Example of the use of point load testing and rock-quality designation, 6:32901

**Well Logging**
Basic program for borelog coding of coal-measure sequences using microcomputers, 6:32900

**COAL-DERIVED LIQUIDS**
*See COAL LIQUIDS*

**COAL-FIRED GAS TURBINES**

**Erosion**
New approach for erosion prediction due to fly ash, 6:33267

**COAL-FIRED MHD GENERATORS**

**Electrodes**
On heat balance in coal-fired MHD systems, channel heat transfer and electrode temperature distribution, 6:33437

**Heat Transfer**
On heat balance in coal-fired MHD systems, channel heat transfer and electrode temperature distribution, 6:33437

**Performance Testing**
Thermal performance analysis of an MHD simulation test facility, 6:33436

**COASTAL REGIONS**

**Baseline Ecology**
Guide to Douglas Point, Charles County, Maryland, 6:33807 (DOE/SR/10018—5)

**Wind Power**
Estimation of time series models for horizontal wind on the Norwegian west coast, 6:33235

**COASTAL WATERS**

**Sampling**
Radiochemical-NAA studies of biological samples in connection with marine production of petroleum, 6:33817 (CONF-800433—)

**COATINGS**
*See also PAINTS*
*PROTECTIVE COATINGS*

**Materials Testing**
Status of low Z coatings for fusion reactor applications, 6:34134 (CONF-801011—(Vol.2))

**Performance Testing**
Performance of TiC-coated graphite in electron-beam tests and Doublet III operation, 6:34172 (GA-A—16384)

**COBALT**

**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)

Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)

**Mass Spectroscopy**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)

**COBALT 59 TARGET**
**Lithium 6 Reactions**
Elastic and inelastic scattering of 88 MeV $^6$Li ions, 6:34013

**Neutron Reactions**
Neutron capture cross section standards for BNL 325, Fourth Edition, 6:34039 (BNL-NCS—51388)

**COBALT COMPLEXES**
**Catalytic Effects**
Processes and techniques, 6:32839 (LBL—12000)

**COBALT OXIDES**
**Decomposition**
Use of oxide decompositions in advanced thermochemical hydrogen cycles for solar heat sources. Application of the tricobalt tetraoxide-cobalt monoxide pair, 6:33074 (LA-UR—81-2628)

**COCOMBUSTION**
**Corrosive Effects**
Cofiring of refuse-derived fuel and coal at Oak Creek. Volume 1. Boiler corrosion evaluation. Final report, 6:33088 (EPRI-CS—1983-Vol.1)

**Economic Analysis**
Feasibility and economic study of medium-Btu coal gas blended with high-Btu by-product gas as an industrial energy source at Billings, Montana. Final report, 6:33082 (DOE/FE/20219—2)

**Feasibility Studies**
Feasibility and economic study of medium-Btu coal gas blended with high-Btu by-product gas as an industrial energy source at Billings, Montana. Final report, 6:33082 (DOE/FE/20219—2)

**CO-GENERATION**
*See COGENERATION*

**COGENERATION**
**Feasibility Studies**
Cogeneration potential: enhanced oil recovery. Final report, 6:32970 (EPRI-EM—1996)

**Institutional Factors**
Institutional obstacles to industrial cogeneration, 6:33393

**COKE OVENS**
**Waste Water**
Treatment of coal-conversion wastewater with the powdered activated carbon-contact-stabilization activated-sludge process. First annual technical progress report, February 1, 1981-July 31, 1981, 6:32867 (DOE/PC/30233—T2)

**COKE-OVEN GAS**
*See COAL GAS*

**COLLIERIES**
*See COAL MINES*

**COLORADO**
**Coal Reserves**
Basic facts about Colorado's energy resources and reserves, 6:33386

**Oil Shale Deposits**
Basic facts about Colorado's energy resources and reserves, 6:33386

**Petroleum Deposits**
Basic facts about Colorado's energy resources and reserves, 6:33386

**Solar Energy**
Basic facts about Colorado's energy resources and reserves, 6:33386

**Uranium Deposits**
Multisource data set integration and characterization of uranium mineralization for the Montrose Quadrangle, Colorado, 6:33014 (LA—8807-MS)
Resource characterization for uranium mineralization in the Montrose 1° x 2° quadrangle, Colorado, 6:33015 (LA-UR—81-2451)

**Uranium Reserves**
Basic facts about Colorado's energy resources and reserves, 6:33386

**COLORIMETRY**
*See ABSORPTION SPECTROSCOPY*

**COLUMBIUM**
*See NIOBIUM*

**COMBINED COLLECTORS**
**Comparative Evaluations**
Cost goals for a residential photovoltaic/thermal liquid collector system set in three northern locations, 6:33097 (MIT-EL—80-028)

**Economic Analysis**
Cost goals for a residential photovoltaic/thermal liquid collector system set in three northern locations, 6:33097 (MIT-EL—80-028)

**COMBINED-CYCLE POWER PLANTS**
**Control**
Entrained gasification combined-cycle control study. Volume 2. Results. Final report, 6:33255 (EPRI-AP—1422-Vol.2)
Entrained gasification combined-cycle control study. Volume 3: model descriptions. Final report, 6:33256 (EPRI-AP—1422-Vol.3)

**Design**
Conceptual design study of potential early commercial MHD powerplant. Final report of Task 2 results, 6:33435 (DOE/NASA/0051—2)

**Economic Analysis**
Conceptual design study of potential early commercial MHD powerplant. Final report of Task 2 results, 6:33435 (DOE/NASA/0051—2)

**Environmental Effects**
Environmental R and D needs for advanced power plants, 6:32895

**Feasibility Studies**
Assessment of coal-using, combined-cycle, heat-engine options for residential/commercial total and integrated energy systems, 6:33252 (ANL/FE—81-55)

**Flue Gas**
Studies of the regeneration of activated bauxite used as granular sorbent for the control of alkali vapors from hot flue gas of coal combustion, 6:33269 (ANL/CEN/FE—81-1)

**Gas Turbines**
Advanced cooling full-scale engine demonstration program. Final report, 6:33259 (EPRI-AP—1933)
Combustion turbine combined-cycle R and D project priority analysis. Final report, 6:33260 (EPRI-AP—1943)
Controlled combustion of a varying low-btu coal-derived gas, 6:32952
Water-cooled gas turbine development program. Final report, 6:33257 (EPRI-AP—1889(Vol.1))
Water-cooled gas turbine development program. Final report, 6:33258 (EPRI-AP—1889-Vol.2)

**Granular Bed Filters**
Studies of the regeneration of activated bauxite used as granular sorbent for the control of alkali vapors from hot flue gas of coal combustion, 6:33269 (ANL/CEN/FE—81-1)

**Hot Gas Cleanup**
Studies of the regeneration of activated bauxite used as granular sorbent for the control of alkali vapors from hot flue gas of coal combustion, 6:33269 (ANL/CEN/FE—81-1)

**COMBUSTION**
*See also FLUIDIZED-BED COMBUSTION*
*IN-SITU COMBUSTION*

**Mathematical Models**
One-dimensional model for pulverized coal combustion and gasification, 6:32837

**Research Programs**
Combustion systems project appraisal analysis. Final report, 6:33388 (DOE/ET/13113—T2)
**Test Facilities**
Measurement of fundamental properties characterizing coal minerals and fireside deposits. First quarterly technical progress report, 1 April 1981-30 June 1981, 6:32859 (DOE/PC/40266—1)

**COMBUSTION KINETICS**
**Mathematical Models**
Kinetics of NO/sub x/ formation during early stages of pulversized-coal combustion. Third quarterly report, 4 April 1981-30 June 1981, 6:32945 (DOE/PC/30295—3)
Model for the progressive combustion analysis of carbonaceous aerosol particles, 6:33756 (LBL—11986)

**COMBUSTION PRODUCTS**
**Chemical Analysis**
Molecular-beam system for the study of transient combustion processes, 6:33626 (LBL—13178)
**Oxidation**
High-explosive detonations in varying-oxygen atmospheres, 6:33716 (UCRL—86563)
**Sampling**
Real time coarse particle mass measurements in a high temperature and pressure coal gasifier process treatment, 6:32805 (BNL—22952)
Real-time coarse-particle mass measurements in a high-temperature/pressure coal-gasifier process treatment, 6:32806 (BNL—29953)

**COMBUSTORS**
**Air Pollution Abatement**
Low NO/sub x/ combustion systems for burning heavy residual fuels and high-fuel-bound nitrogen fuels, 6:32951
**Design**
Design and preliminary results of a fuel flexible industrial gas turbine combustor, 6:32950
**Protective Coatings**
Fossil energy, 6:32862 (LBL—12000)

**COMETS**
**Environmental Impacts**
Reduction of photosynthetically active radiation under extreme stratospheric aerosol loads, 6:33745 (LA—8938-MS)

**COMMERCIAL BUILDINGS**
**Solar Air Conditioning**
Performance predictions of passive solar commercial buildings, 6:33161 (CONF-811034—1)
**Solar Space Heating**
Performance predictions of passive solar commercial buildings, 6:33161 (CONF-811034—1)

**COMMUNICATIONS**
*See also DATA TRANSMISSION*
**Security**
Identifier protection in a distributed operating system, 6:34203 (UCRL—86143)

**COMPARATIVE EVALUATIONS**
**Knock-Out Reactions**
Comparison of pion and photon induced reactions on complex nuclei, 6:34001

**COMPATIBILITY (IMMUNOLOGICAL)**
*See IMMUNITY*

**COMPOUND NUCLEI**
**Energy-Level Transitions**
Angular momentum effects in fusion-fission and fusion-evaporation reactions, 6:34035

**COMPOUND-NUCLEUS REACTIONS**
**Fission**
Angular momentum effects in fusion-fission and fusion-evaporation reactions, 6:34035
**Many-Nucleon Transfer Reactions**
Search for resonances in $^{12}C(^{9}Be,\alpha)^{17}O$, 6:34003

**COMPOUNDS (ORGANIC)**
*See ORGANIC COMPOUNDS*

**COMPRESSED AIR ENERGY STORAGE**
**Research Programs**
Reservoir stability studies, 6:33370 (PNL-SA—9782)

**COMPRESSED AIR ENERGY STORAGE EQUIPMENT**
**Parametric Analysis**
Thermodynamic behavior of compressed air energy storage systems, 6:33368 (DOE/OR/90337—T1)
**Thermodynamics**
Thermodynamic behavior of compressed air energy storage systems, 6:33368 (DOE/OR/90337—T1)

**COMPRESSED AIR STORAGE POWER PLANTS**
**Compressors**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 9. Design approaches: CAES, Appendix C. Major mechanical equipment. Final report, 6:33369 (EPRI-EM—1589(Vol.9)(App.C))
**Heat Recovery Equipment**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 9. Design approaches: CAES, Appendix C. Major mechanical equipment. Final report, 6:33369 (EPRI-EM—1589(Vol.9)(App.C))
**Turbogenerators**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 9. Design approaches: CAES, Appendix C. Major mechanical equipment. Final report, 6:33369 (EPRI-EM—1589(Vol.9)(App.C))

**COMPRESSION STRENGTH**
**Measuring Instruments**
Application of a roof bolt hole penetrometer to the determination of in situ strength of coal-measure sediments, 6:32917

**COMPRESSORS**
*See also GAS COMPRESSORS*
**Cooling Systems**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 9. Design approaches: CAES, Appendix C. Major mechanical equipment. Final report, 6:33369 (EPRI-EM—1589(Vol.9)(App.C))
**Design**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 9. Design approaches: CAES, Appendix C. Major mechanical equipment. Final report, 6:33369 (EPRI-EM—1589(Vol.9)(App.C))
**Speed Regulators**
Variable capacity compressor controller, 6:33448 (DOE/CS/35224—T1)

**COMPUTER CODES**
Data collection and processing for the ACES, 6:33459 (ORNL/CON—59)
Edge stresses in spherical-shell solar receivers, 6:33193 (DOE/ET/21015—11)
Monte Carlo computer program for the transport of energetic ions in amorphous targets, 6:34041
**B Codes**
Terrestrial solar spectral modeling, 6:33096 (SERI/TP—642-1343)
**C Codes**
Solar energy conversion systems engineering and economics analysis. Input definition. Volume II, 6:33095 (MIT-EL—79-033-Vol.2)
**D Codes**
DARTAB: a program to combine airborne radionuclide environmental exposure data with dosimetric and health effects data to generate tabulations of predicted health impacts, 6:33889 (ORNL—5692)
DISFUL manual, 6:33018 (DOE/SR/01069—1)
DOE-2.1 building energy analysis group, 6:33455 (LBL—11985)
**G Codes**
GATO: an MHD stability code for axisymmetric plasmas with internal separatrices, 6:34060 (GA-A—16441)
**I Codes**
Hydrologic studies support, INTERCOMP code conversion. Annual report. Research report 80/15-44, 6:33023 (DOE/RL/10119—1)

**K Codes**
Detonation-product behavior at large expansion: the underwater detonation of nitromethane (KOEOP code), 6:33714 (UCRL—52903)
**L Codes**
Description and use of the Monte Carlo code LILITA (Modeling of equilibrium decay of heavy ion reaction products), 6:34019 (ORNL/TM—7295)
Generation planning system: methodology and case study. Final report (LOADST), 6:33423 (EPRI-EA—1807)
**M Codes**
General review of the MOSTAS computer code for wind turbines, 6:33241 (DOE/NASA/3303—1)
**Optimization**
Generation planning system: methodology and case study. Final report (LOADST), 6:33423 (EPRI-EA—1807)
**P Codes**
PAPIN: A Fortran-IV program to calculate cross section probability tables, Bondarenko and transmission self-shielding factors for fertile isotopes in the unresolved resonance region, 6:34028 (ORNL/TM—7883)
Phased-mission system reliability analysis. Volume 2: computer code. Final report, 6:33350 (EPRI-NP—1945(Vol.2))
Photovoltaic market analysis program: background, model development, applications and extensions, 6:33098 (MIT-EL—81-012)
PV1 model verification and validation, 6:33132 (MIT-EL—81-004)
**Planning**
Generation planning system: methodology and case study. Final report (LOADST), 6:33423 (EPRI-EA—1807)
**R Codes**
Program ROCMAS: introduction and user's guide, 6:33931 (LBL—12987)
REFUEL: a computer program for automated BWR fuel management. Final report, 6:33319 (EPRI-NP—1920)
**S Codes**
Manual for use with the computer code SUPERENERGY: data reduction version (LMFBR), 6:33304 (DOE/ET/37240—74TR)
Terrestrial solar spectral modeling, 6:33096 (SERI/TP—642-1343)
**T Codes**
TCLUST1: a computer program for analysis of intersubassembly heat transfer in an LMFBR, 6:33301 (ANL—81-18)
**Validation**
PV1 model verification and validation, 6:33132 (MIT-EL—81-004)

**COMPUTER NETWORKS**
**Data Transmission**
Preliminary report on a theory of authentication, 6:34195 (SAND—81-1007C)

**COMPUTER PROGRAMMING**
*See PROGRAMMING*

**COMPUTERIZED CONTROL SYSTEMS**
**Maintenance**
Minicomputer and computer numerical control maintenance, 6:33643 (Y/IA—152)
**Performance**
Digital control of machine tools, 6:33642 (Y—2227)

**COMPUTERIZED TOMOGRAPHY**
**Image Processing**
Direct image reconstruction with limited angle projection data for computerized tomography, 6:33865 (CONF-800433—)

**COMPUTERS**
*See also DIGITAL COMPUTERS*
**Forecasting**
Concerning technical means for dealing with aspects of the near-term information onslaught, 6:34198 (UCRL—86581)
**Performance**
Concerning technical means for dealing with aspects of the near-term information onslaught, 6:34198 (UCRL—86581)
**Uses**
Concerning technical means for dealing with aspects of the near-term information onslaught, 6:34198 (UCRL—86581)

**CONCENTRATING COLLECTORS**
**Performance Testing**
Performance testing of the TOLTEC TI-410 concentrating solar collector, 6:33195 (SAND—81-0369)

**CONCRETES**
**Chemical Analysis**
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
**Chemical Composition**
Storage and solidification of MAW/LAW in underground caverns (Phase 2). Studies on product conveyance in fall pipelines. Reporting period, July 1, 1979-December 31, 1979, 6:33020 (ORNL-tr—4777)
**Creep**
Finite-element program for creep analysis of concrete structures, 6:33556 (CONF-810801—57)
**Mechanical Properties**
Lightweight concrete materials and structural systems for water tanks for thermal storage. Final report, 6:33372 (COO—4703-26)
**Nuclear Reaction Analysis**
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
**Thermal Conductivity**
Lightweight concrete materials and structural systems for water tanks for thermal storage. Final report, 6:33372 (COO—4703-26)
**Transport**
Storage and solidification of MAW/LAW in underground caverns (Phase 2). Studies on product conveyance in fall pipelines. Reporting period, July 1, 1979-December 31, 1979, 6:33020 (ORNL-tr—4777)
**X-Ray Fluorescence Analysis**
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)

**CONDENSED AROMATICS**
*See also NAPHTHALENE*
**Chemical Bonds**
Model compound study of the mechanism of $sp^2$-$sp^3$ carbon-carbon cleavage during the reduction of coals (Bibenzyl, diphenylmethane, α-benzylnaphthalene), 6:33606 (CONF-810914—4)
**Chemical Reaction Kinetics**
Model compound study of the mechanism of $sp^2$-$sp^3$ carbon-carbon cleavage during the reduction of coals (Bibenzyl, diphenylmethane, α-benzylnaphthalene), 6:33606 (CONF-810914—4)

**CONSERVATION (ENERGY)**
*See ENERGY CONSERVATION*

**CONTAINERS**
*See also HOPPERS*
*PRESSURE VESSELS*
*TANKS*
**Materials**
Fracturing of simulated high-level waste glass in canisters, 6:33041 (PNL—3948)

**CONTAINMENT BUILDINGS**
Evaluation of high-pressure containment buildings for LMFBR's (1000 MW(e); consequence mitigation), 6:33359 (HEDL-SA—2292-FP)

**CONTAMINATION**
*(For radioactive contamination only; see also POLLUTION.)*
**Radiation Monitoring**
Environmental radiological survey of the intermediate-level waste system pipeline, 6:33803 (ORNL/TM—7858)

**CONTROL ROOMS**
**Design**
Evaluation of proposed control room improvements through analysis of critical operator decisions. Final report, 6:33333 (EPRI-NP—1982)
**Display Devices**
Janus displays for improved reactor plant operation and control, 6:33331 (CONF-810606—71)
**Modifications**
Evaluation of proposed control room improvements through analysis of critical operator decisions. Final report, 6:33333 (EPRI-NP—1982)

**CONTROL SYSTEMS**
*(For automated processes including feedback.)*
*See also COMPUTERIZED CONTROL SYSTEMS*
*ON-LINE CONTROL SYSTEMS*
*REACTOR CONTROL SYSTEMS*
Performance analysis for horizontal axis wind turbines applicable to variable pitch or airbrake control, 6:33249
**Computerized Simulation**
Analysis by hybrid computer simulation of a power level control system for a tokamak fusion reactor plasma, 6:34081 (CONF-801011—(Vol.1))
**CONTROL THEORY (REACTOR)**
*See REACTOR KINETICS*
**CONTROLLED ATMOSPHERES**
**Design**
Assessment of optimum microcosm design for pollution impact studies, 6:33911 (LBL—11986)
**COOLERS**
*See HEAT EXCHANGERS*
**COOLING LOAD**
**Calculation Methods**
Incremental cooling load determination for passive direct gain heating systems, 6:33173 (LBL—12048)
**COOLING TOWERS**
*See also NATURAL DRAFT COOLING TOWERS*
**Operation**
Magma cooling-tower process pilot-plant demonstration. Final report, 6:33261 (EPRI-CS—1838)
**Performance**
Magma cooling-tower process pilot-plant demonstration. Final report, 6:33261 (EPRI-CS—1838)
**COPOLYMERS**
**Photolysis**
Intramolecular energy transfer in polymers containing benzoyl and naphthalene moieties, 6:33613
**COPPER**
**Argon 40 Reactions**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**Carbon 12 Reactions**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Impact Tests**
Time-resolved wave profile measurements in copper to Megabar pressures, 6:33533 (SAND—81-1358C)
**Mass Spectroscopy**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
**Measuring Methods**
Neutron activation analysis of copper and silver in environmental samples, 6:33736 (CONF-800433—)
**Muon Probes**
Low temperature diffusion of positive muons in copper, 6:33957 (LA-UR—81-2473)
**Physical Radiation Effects**
Damage development and hardening in 14 MeV neutron irradiation of copper alloys at 25°C, 6:33515 (HEDL-SA—2357)
**Shear Properties**
Time-resolved wave profile measurements in copper to Megabar pressures, 6:33533 (SAND—81-1358C)
**COPPER ALLOYS**
**Corrosion**
Effect of mechanical cleaning on seawater corrosion of candidate OTEC heat exchanger materials. Part 2. Tests with Amertap sponge rubber balls, 6:33149 (ANL/OTEC-BCM—018)
**Diffusion**
Zero-flux planes and flux reversals in multicomponent diffusion. Progress report, January 1, 1981-August 31, 1981 (Cu-Ni-Zn; Fe-Ni-Cr), 6:33508 (DOE/ER/10814—1)
**Physical Radiation Effects**
Damage development and hardening in 14 MeV neutron irradiation of copper alloys at 25°C, 6:33515 (HEDL-SA—2357)
**COPPER SELENIDES**
**Electric Conductivity**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**Fabrication**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**Tensile Properties**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**Thermal Conductivity**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**COPPER SULFIDES**
**Sputtering**
Cadmium sulfide/copper sulfide heterojunction cell research by sputter deposition. Quarterly technical progress report, December 1, 1980-February 28, 1981, 6:33119 (SERI/PR—9296-T1)
**CORE FLOODING SYSTEMS**
**Performance**
Studies of transition boiling heat transfer with saturated water at 1-4 bar. Final report, 6:33349 (EPRI-NP—1899)
**Temperature Monitoring**
Brazing of sensors for high-temperature steam instrumentation systems, 6:33363
**CORN (MAIZE)**
*See MAIZE*
**CORNEA**
**Therapy**
Technique for the selective heating of corneal stroma, 6:33870
**CORROSION PRODUCTS**
**Activation Analysis**
Neutron-activation analysis of turbine deposits. Interim report, 6:33573 (EPRI-CS—1958)
**COSMIC GAMMA BURSTS**
**Cosmic Ray Detection**
Ion chamber gamma burst detector, 6:33936 (LA-UR—81-2591)
**Gamma Spectra**
Spectral evolution of the 5 March 1979 $\gamma$ burst, 6:33937
**Soft X Radiation**
Ion chamber gamma burst detector, 6:33936 (LA-UR—81-2591)
**COSMIC PARTICLES**
*See COSMIC RADIATION*
**COSMIC RADIATION**
*See also COSMIC GAMMA BURSTS*
**Acceleration**
Fermi acceleration revisited, 6:33951

**COSMIC RAY DETECTION**
**Ionization Chambers**
Ion chamber gamma burst detector, 6:33936 (LA-UR—81-2591)
**COSMOLOGY**
**Baryon Number**
Neutrino number of the universe, 6:33934 (LA-UR—81-2505)
**Lepton Number**
Neutrino number of the universe, 6:33934 (LA-UR—81-2505)
**COUMARIN**
**Fluorescence Spectroscopy**
Two-laser induced selective infrared-visible fluorescence for thin film analysis, 6:33584
**Laser Spectroscopy**
Two-laser induced selective infrared-visible fluorescence for thin film analysis, 6:33584
**COUNTY BUILDINGS**
*See PUBLIC BUILDINGS*
**COURT BUILDINGS**
*See PUBLIC BUILDINGS*
**COVERINGS**
**Erosion**
Stability of multilayer earthen barriers used to isolate mill tailings: geologic and geotechnological considerations, 6:33040 (PNL—3902)
**Seismic Effects**
Stability of multilayer earthen barriers used to isolate mill tailings: geologic and geotechnological considerations, 6:33040 (PNL—3902)
**CP INVARIANCE**
**Rest Mass**
Large distance effects in CP violation and the $K^0$-anti $K^0$ mass matrix, 6:33984
**CRABS**
*See CRUSTACEANS*
**CRBR REACTOR**
*See CLINCH RIVER BREEDER REACTOR*
**C-REACTIVE PROTEIN**
*See IMMUNITY*
**CREEKS**
*See RIVERS*
**CRITICALITY ACCIDENTS**
*See RADIATION ACCIDENTS*
**CROSS SECTIONS**
**Nuclear Data Collections**
ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)
**Nuclear Potential**
Role of the attractive nuclear potential in determining reaction cross sections, 6:34033
**CROSS-RIDGE MINING**
**Evaluation**
Valuation of surface mining design to improve post-mining land resources, 6:32886 (ANL/LRP-TM—20)
**CRUDE OIL**
*See PETROLEUM*
**CRUSTACEANS**
**Activation Analysis**
Study of heavy elements (Cd, Hg and Se) in the aquatic environment around Bombay by radiochemical neutron activation analysis, 6:33814 (CONF-800433—)
**Multi-Element Analysis**
Study of heavy elements (Cd, Hg and Se) in the aquatic environment around Bombay by radiochemical neutron activation analysis, 6:33814 (CONF-800433—)
**CRYOGENIC CABLES**
**Gas Cooling**
Gas cooled electrical leads for use on forced cooled superconducting magnets, 6:33637 (LBL—12783)
**Performance Testing**
Gas cooled electrical leads for use on forced cooled superconducting magnets, 6:33637 (LBL—12783)
**CRYOPUMPS**
**Performance**
Cryopumping of hydrogen and helium, 6:33630 (BNL—30012)
**CRYSTAL LATTICES**
*See also BETA-W LATTICES*
**Mathematical Models**
Self-consistent approximation beyond the CPA: Part II, 6:33506 (CONF-810866—1(Draft))
**Positron Channeling**
Slow positrons in the study of surface and near-surface defects, 6:33953 (BNL—29798)
**CRYSTAL-PHASE TRANSFORMATIONS**
**Reviews**
Recent advances in the study of structural phase transitions at high pressure, 6:34046 (SAND—81-1151C)
**CS-R PROCESS**
Surface Coal Gasification, 6:32819 (DOE/METC/SP—110)
**Separation Processes**
Cryogenic methane separation/catalytic hydrogasification process analysis. Quarterly report, 6:32811 (DOE/ET/10325—T11)
**CULM**
**Fluidized-Bed Combustion**
Fluidized-bed-fired industrial boilers, 6:33663
**CUTTING TOOLS**
**Performance**
Structure-property correlations for $TiB_2$-based ceramics densified using active liquid metals, 6:33546 (CONF-810856—1)
**CYCLOTRONS**
**Beam Injection**
Helical axial injection concept for cyclotrons, 6:33670 (CONF-810944—1)
**CYTOCHROMES**
**Nuclear Magnetic Resonance**
Analysis of field-dependent relaxation data and hyperfine shifts of cytochrome c′ from Rhodospirillum rubrum in terms of the high-spin iron ligation states, 6:33593
**CYTOSINE**
**Genetic Effects**
Sensitivity of excision repair in normal human, xeroderma pigmentosum variant and Cockayne's syndrome fibroblasts to inhibition by cytosine arabinoside, 6:33893
**CZECHOSLOVAKIA**
**Underground Mining**
Emphasis in overseas research on underground coal mining: geomechanical implications (Australian report), 6:32904 (CSIRO—2)

## D

**DARRIEUS ROTORS**
**Aerodynamics**
Wind ripple analysis, 6:33240 (DOE/DP/00789—T15)
Wind tunnel tests of sailwings for Darrieus rotors, 6:33245
**Evaluation**
Wind turbine, 6:33247
**Performance**
Wind ripple analysis, 6:33240 (DOE/DP/00789—T15)
**Performance Testing**
Wind turbine, 6:33247
**Research Programs**
Wind turbine, 6:33247
**DATA TRANSMISSION**
**Security**
Preliminary report on a theory of authentication, 6:34195 (SAND—81-1007C)
**DAUGHTER PRODUCTS**
**Alpha Spectroscopy**
Alpha-spectroscopic techniques for field measurement of radon daughters, 6:33766 (LBL—10769)
**DAVIS BESSE-1 REACTOR**
**Electrical Equipment**
Technical evaluation of the station and instrument ground grid systems at the Davis Besse Nuclear Power Station, Unit 1, 6:33299 (UCID—19105)

**Engineered Safety Systems**
Technical evaluation of the noise and isolation testing of the safety features actuation system at the Davis Besse Nuclear Power Station, Unit 1, 6:33298 (UCID—19104)
**Reactor Instrumentation**
Technical evaluation of the station and instrument ground grid systems at the Davis Besse Nuclear Power Station, Unit 1, 6:33299 (UCID—19105)
**Reactor Protection Systems**
Technical evaluation of the noise and isolation testing of the safety features actuation system at the Davis Besse Nuclear Power Station, Unit 1, 6:33298 (UCID—19104)

**DAYLIGHTING**
**Research Programs**
Energy-efficient windows program, 6:33453 (LBL—11985)

**DECONTAMINATION**
**Cost**
Engineering assessment of inactive uranium mill tailings, Naturita Site, Naturita, Colorado, 6:33024 (DOE/UMT—012)
Engineering assessment of inactive uranium mill tailings, Shiprock site, Shiprock, New Mexico, 6:33026 (DOE/UMT—0104)
Summary of the engineering assessment of inactive uranium mill tailings, Naturita site, Naturita, Colorado, 6:33025 (DOE/UMT—012S)
Summary of the engineering assessment of inactive uranium mill tailings, Shiprock Site, Shiprock, New Mexico, 6:33027 (DOE/UMT—0104S)

**DEEP INELASTIC HEAVY ION REACTIONS**
**Nucleosynthesis**
Recent searches for superheavy elements in deep-inelastic reactions, 6:34029

**DEMONSTRATION PLANTS**
*See also INDUSTRIAL PLANTS*
*PROCESS DEVELOPMENT UNITS*
**Chemical Effluents**
Applicability of the industrial source complex dispersion model to the SRC-I Demonstration Plant, 6:32825 (DOE/OR/03054—3)
**Environmental Impacts**
Applicability of the industrial source complex dispersion model to the SRC-I Demonstration Plant, 6:32825 (DOE/OR/03054—3)
**Pollution Control**
Particulate control in process area 12 (solvent-refined coal process and deashing), 6:32826 (DOE/OR/03054—3)
**Site Selection**
Site confirmation study, 6:32824 (DOE/OR/03054—3)

**DENSITY MATRIX**
**Statistics**
Estimation problems associated with the Weibull distribution, 6:34194 (ORNL/CSD—79)

**DEOXYPENTOSE NUCLEIC ACID**
*See DNA*

**DEOXYRIBONUCLEIC ACID**
*See DNA*

**DEPARTMENT OF INTERIOR**
*See US DOI*

**DESOXYRIBONUCLEIC ACID**
*See DNA*

**DESULFURIZATION**
**Economic Analysis**
Evaluation of dry alkalis for removing sulfur dioxide from boiler flue gases. Final report, 6:33270 (EPRI-FP—207)
**Evaluation**
Evaluation of dry alkalis for removing sulfur dioxide from boiler flue gases. Final report, 6:33270 (EPRI-FP—207)

**DETONATORS**
**Computerized Simulation**
Computer modeling of an all-secondary explosive hot-wire device, 6:33708 (LA—8930-MS)
**Design**
Deflagration-to-detonation transition (DDT) project. Semiannual report, June-November 1980, 6:33713 (SAND—81-0937)
**Detection**
Evaluation of active and passive near-millimeter-wave radiometric imaging techniques for detection of concealed objects, 6:33062 (SAND—81-1051)
**Exploding Wires**
Computer modeling of an all-secondary explosive hot-wire device, 6:33708 (LA—8930-MS)
**Performance Testing**
Deflagration-to-detonation transition (DDT) project. Semiannual report, June-November 1980, 6:33713 (SAND—81-0937)

**DETRITUS**
**Population Dynamics**
Effects of light on biomass and community structure of estuarine detrital microbiota, 6:33917

**DEUTERIUM**
**Isotopic Exchange**
Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Annual progress report, February 1980-February 1981, 6:32834 (DOE/PC/30080—4)

**DEUTERIUM IONS**
**Charge Exchange**
Production and destruction of $D^-$ by charge transfer in metal vapors, 6:34180 (LBL—12995)

**DEUTERIUM TARGET**
High-current deuterium gas target for neutron nuclear data research, 6:34040
**Electron Reactions**
Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)
**Proton Reactions**
Description of polarization analyzing powers for three-body breakup reactions, 6:33998
Inclusive proton spectra and total reaction cross sections for proton-nucleus scattering at 800 MeV, 6:33997 (LA—8937-T)

**DEUTERON REACTIONS**
**Breakup Reactions**
Description of polarization analyzing powers for three-body breakup reactions, 6:33998
**Total Cross Sections**
Energy dependence of nucleus-nucleus total cross sections, 6:34006

**DEUTERON-DEUTERON INTERACTIONS**
*See DEUTERIUM TARGET*
*DEUTERON REACTIONS*

**DEVELOPING COUNTRIES**
**Demography**
Impact of economic and demographic growth on oil and gas availability from less developed countries, 6:33408 (EPRI-WS—79-182)
**Energy Consumption**
Impact of economic and demographic growth on oil and gas availability from less developed countries, 6:33408 (EPRI-WS—79-182)
**Resource Development**
Contracts or concessions for exploration and production, 6:33411 (EPRI-WS—79-182)
Effect of the prospective investment climate on future oil and gas supplies from foreign sources, 6:33410 (EPRI-WS—79-182)
Impact of economic and demographic growth on oil and gas availability from less developed countries, 6:33408 (EPRI-WS—79-182)

**DEVONIAN SHALES**
*See BLACK SHALES*

**DIAPHRAGMS (THERMONUCLEAR DEVICE)**
*See LIMITERS*

**DICHLORODIETHYLAMINE**
*See NITROGEN MUSTARD*

**DIELECTRIC MATERIALS**
*See also FERROELECTRIC MATERIALS*
**Breakdown**
Partial discharge inception and extinction studies in polymer film structures impregnated with compressed $SF_6$ gas, 6:33276 (CONF-811016—2)

**Electrical Insulation**
Partial discharge inception and extinction studies in polymer film structures impregnated with compressed $SF_6$ gas, 6:33276 (CONF-811016—2)
**Performance Testing**
High temperature electrical conductivity and thermal decomposition of phenolic- and silicon-based dielectrics for fireset housings, 6:33560 (SAND—81-0786)

**DIELECTRICS**
*See DIELECTRIC MATERIALS*

**DIESEL ENGINES**
**Bottoming Cycles**
Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 1. Executive summary, 6:33484 (DOE/CS/54224—T1-Vol.1)
Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 2. Final technical report, 6:33485 (DOE/CS/54224—T1-Vol.2)

**DIESEL FUELS**
**Chemical Composition**
Liquid-liquid chromatography fractionation of organic compounds in complex mixtures: application to automobile exhaust, 6:33575 (IS-T—914)

**DIFFRACTOMETERS**
**Design**
Instrument for liquids, amorphous and power diffraction, 6:33578 (LA-UR—81-2531)

**DIFFUSION**
**Mathematical Models**
Handbook on atmospheric diffusion models, 6:33724 (ATDL—81/5)

**DIGESTIVE SYSTEM**
*See also LIVER*
**Biological Radiation Effects**
Abstracts of twenty-ninth annual meeting of the Radiation Research Society, Minneapolis, Minnesota, 31 May-4 June 1981 (Lead abstract), 6:33897

**DIGITAL COMPUTERS**
**Timing Circuits**
Clock distribution system for digital computers (Patent), 6:33656

**DIGITAL FILTERS**
**Symmetry**
Quadrantal symmetry calculations for nonsymmetric half-plane filters, 6:34197 (UCRL—85156-Rev.1)

**DIMETHYLBENZENES**
*See XYLENES*

**DIRAC EQUATION**
**Wave Functions**
Dirac's new relativistic wave equation in interaction with an electromagnetic field, 6:34049 (DOE/ER/03992—448)

**DIRECT CONTACT HEAT EXCHANGERS**
**Design**
Design and economics of direct-contact salt hydrate storage systems, 6:33203 (SERI/TP—631-1163)
**Economic Analysis**
Design and economics of direct-contact salt hydrate storage systems, 6:33203 (SERI/TP—631-1163)

**DIRECT GAIN SYSTEMS**
**Computerized Simulation**
Verification of BLAST by comparison with measurements of a solar-dominated test cell and a thermally massive building, 6:33172 (LBL—11387)
**Performance**
Comparative thermal performance of direct gain, Trombe, and sunspace walls, 6:33158 (BNL—29970)
Incremental cooling load determination for passive direct gain heating systems, 6:33173 (LBL—12048)
**Performance Testing**
Verification of BLAST by comparison with measurements of a solar-dominated test cell and a thermally massive building, 6:33172 (LBL—11387)

**DISPLAY DEVICES**
Janus displays for improved reactor plant operation and control, 6:33331 (CONF-810606—71)

**DISTRIBUTED COLLECTOR POWER PLANTS**
**Modifications**
Dish Stirling solar receiver program. Final report, 6:33145 (NASA-CR—163889)

**DISTRICT HEATING**
**Environmental Impacts**
Impacts of Federal clean air law on district-heating opportunities, 6:33770 (BNL—51389)
**Evaluation**
Potential opportunities for revitalization of the Rochester, New York steam district heating system, 6:33479 (ORNL/TM—7757)
**Feasibility Studies**
Moorhead district heating. Phase II. Final report, 6:33473 (DOE/CS/20074—1)
**Reviews**
Potential opportunities for revitalization of the Rochester, New York steam district heating system, 6:33479 (ORNL/TM—7757)

**DISUSED MINESHAFTS**
*See ABANDONED SHAFTS*

**DIVERTORS**
*See also BUNDLE DIVERTORS*
*POLOIDAL DIVERTORS*
**Design**
Crossed-field divertor for a plasma device (Patent), 6:34192
**Test Facilities**
Electric field bumpy torus plasma as a test bed for plasma-wall interaction studies, 6:34145 (CONF-801011—(Vol.3))

**D-LI HIGH FLUX NEUTRON SOURCE FACILITY**
*See NEUTRON SOURCE FACILITIES*

**DNA**
*(Deoxyribonucleic acid.)*
**Biological Repair**
Analysis of resynthesis tracts in repaired Escherichia coli deoxyribonucleic acid, 6:33899
Mammalian life histories: their evolution and molecular-genetic mechanisms, 6:33881
Molecular mechanisms of pyrimidine dimer excision in Saccharomyces cerevisiae: excision of dimers in cell extracts, 6:33901
**Biosynthesis**
Chromatographic evidence that the AAA-coding isoacceptor of lysine tRNA primes DNA synthesis in murine mammary tumor virus, 6:33875
**Dichroism**
Contribution of light scattering to the circular dichroism of deoxyribonucleic acid films, deoxyribonucleic acid-polylysine complexes, and deoxyribonucleic acid particles in ethanolic buffers, 6:33599
**Molecular Biology**
Adenovirus type 2 early proteins: assignment of the early region 1A proteins synthesized in Vivo and in Vitro to specific mRNAs, 6:33874

**DODECANE**
**Evaporation**
Multicomponent fuel droplet vaporization at large Reynolds numbers, 6:33627
**Liquid Column Chromatography**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**NMR Spectra**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)

**DOLOMITE**
Hydration enhanced sulfation of limestone and dolomite in the fluidized-bed combustion of coal, 6:32954

**DORMITORIES**
*See RESIDENTIAL BUILDINGS*

**DOUBLET 3 DEVICES**
*See DOUBLET REACTORS*

**DOUBLET REACTORS**
**Magnetic Surfaces**
Reactor aspects of expanded boundary approach, 6:34082 (CONF-801011—(Vol.1))

**Plasma Macroinstabilities**
GATO: an MHD stability code for axisymmetric plasmas with internal separatrices, 6:34060 (GA-A—16441)

**DRILL BITS**
*See also DRILLS*
*ROTARY DRILLS*
**Design**
Design and computation of diameter of rock bit, 6:33645

**DRILLING FLUIDS**
**Rheology**
Power-law rheology and flow behavior of low-invasion coring fluids, 6:33230 (SAND—80-0933)
**Viscosity**
Power-law rheology and flow behavior of low-invasion coring fluids, 6:33230 (SAND—80-0933)

**DRILLING MUD**
*See DRILLING FLUIDS*

**DRILLING PLATFORMS**
*See OFFSHORE PLATFORMS*

**DRILLING RIGS**
**Mechanical Transmissions**
Technology of strengthening the power transmission chains for oilfield drilling rigs, 6:32975

**DRILLS**
*See also DRILL BITS*
*ROTARY DRILLS*
**Surveys**
Drill geometries for miniature holes, 6:33628 (BDX—613-2623)

**DROPLETS**
**Evaporation**
Multicomponent fuel droplet vaporization at large Reynolds numbers, 6:33627

**DROSOPHILA**
**Genetic Mapping**
Third-chromosome mutagen-sensitive mutants of Drosophila melanogaster, 6:33861
**Germ Cells**
Progress report for mutagenic effect of radionuclides incorporated into DNA of Drosophilia melangaster, 6:33887 (DOE/EV/03728—T1)
**Mutagenesis**
Progress report for mutagenic effect of radionuclides incorporated into DNA of Drosophilia melangaster, 6:33887 (DOE/EV/03728—T1)
**Population Dynamics**
Fitness and density-dependent population growth in Drosophila melanogaster, 6:33862

**DUAL-PURPOSE POWER PLANTS**
**Gas Turbines**
External combustion steam injected gas turbine for cogeneration. Final report, 6:33254 (DOE/ET/11448—T1)

**DUST COLLECTORS**
**Comparative Evaluations**
Central station dust control for coal handling equipment, 6:32940 (EPRI-WS—79-236)

**DUSTS**
**Control**
Central station dust control for coal handling equipment, 6:32940 (EPRI-WS—79-236)
Chemical crusting of coal stockpiles for the control of fugitive dust, water erosion, water penetration and spontaneous firing, 6:32939 (EPRI-WS—79-236)
Coal and ash handling in a typical industrial boiler plant, 6:33647
Control of the fugitive dust during the loading of trucks with western coal fly ash, 6:32894 (EPRI-WS—79-236)
Mine demonstrations of longwall dust control techniques. Technical status report, July 31, 1981-August 31, 1981, 6:32908 (DOE/ET/12532—T4)
**Measuring Methods**
Nuclear magnetic resonance method for observation of ferromagnetic pulmonary contaminants, 6:33906 (CONF-800433—)
**Monitoring**
Control of the fugitive dust during the loading of trucks with western coal fly ash, 6:32894 (EPRI-WS—79-236)

**DYE LASERS**
**Research Programs**
XeF pump laser. Final technical report, 6:33649 (UCRL—15348)

**DYSPROSIUM 148**
**Yrast States**
Yrast spectroscopy: status of yrast isomers, oblate shapes and feeding of yrast states, 6:34015

**DYSPROSIUM 151**
**Yrast States**
Yrast spectroscopy: status of yrast isomers, oblate shapes and feeding of yrast states, 6:34015

**DYSPROSIUM 152**
**Yrast States**
Yrast spectroscopy: status of yrast isomers, oblate shapes and feeding of yrast states, 6:34015

## E

**EARTH ATMOSPHERE**
*See also AIR*
*STRATOSPHERE*
*SURFACE AIR*
*TROPOSPHERE*
**Light Scattering**
Terrestrial solar spectral modeling, 6:33096 (SERI/TP—642-1343)
**Light Transmission**
Terrestrial solar spectral modeling, 6:33096 (SERI/TP—642-1343)
**Radionuclide Migration**
Environmental concentration and migration of $^{129}I$, 6:33767 (PNL-SA—9140)

**EARTHMOVING EQUIPMENT**
**Cost**
Costs of recontouring abandoned mined land, 6:32891 (ANL/LRP-TM—20)
Dragline reclamation of abandoned contour mines, 6:32890 (ANL/LRP-TM—20)
**Design**
Develop a winch-drawn dozer blade equipment system: modification A010-spoil-plane for leveling surface mine spoils. Semi-annual technical progress report, 6:32893 (DOE/ET/12394—T2)

**EARTHQUAKES**
*See also SEISMIC WAVES*
**Meetings**
Workshop on seismic performance of underground facilities, 6:33029 (DPST—81-262)
**Seismic Effects**
Damage to underground structures during earthquakes, 6:33925 (DPST—81-262)
Earthquake damage to underground facilities, 6:33924 (DPST—81-262)
Earthquake engineering of large underground structures, 6:33033 (DPST—81-262)

**EAST COAST**
**Geothermal Resources**
Multi-task support to the Division of Geothermal Energy's hydrothermal resources program. Final report, 6:33206 (DOE/EV/10072—5)

**EBR-2 REACTOR**
**Fuel Pins**
Technique for preparation of prototypic fast test reactor mixed-oxide fuel pins for ceramography and metallography, 6:33309 (HEDL-SA—2333-FP)

**EFFLUENTS (CHEMICAL)**
*See CHEMICAL EFFLUENTS*

**EHV AC SYSTEMS**
**Power Transmission Lines**
Investigation of corona and field effects of ac/dc hybrid transmission lines, 6:33286
Investigation of geomagnetically induced currents in the proposed Winnipeg-Duluth-Twin Cities 500-kV transmission line. Final report, 6:33279 (EPRI-EL—1949)

**Switches**
Application of high-speed grounding switches for single-pole reclosing on 500 kV power systems, 6:33283
**EHV DC SYSTEMS**
**Power Transmission Lines**
Investigation of corona and field effects of ac/dc hybrid transmission lines, 6:33286
Laboratory development of +-600 kV dc pipe cable system, 6:33284
**ELASTOMERS**
**Mechanical Properties**
Nonlinear theory of viscoelasticity for application to elastomers, 6:33554
**ELECTRIC BATTERIES**
*(Devices for production and/or storage of electrical energy from chemical reactions; excludes FUEL CELLS and RADIOISOTOPE BATTERIES.)*
*See also METAL-GAS BATTERIES*
*METAL-NONMETAL BATTERIES*
**Research Programs**
Energy storage, 6:33378 (LBL—12000)
**ELECTRIC CABLES**
*See also CRYOGENIC CABLES*
**Acoustic Monitoring**
Acoustic waveguide technique for sensing incipient faults in underground power-transmission cables: including acousto-optic techniques. Final report, 6:33277 (DOE/ET/29335—T1)
**Cathodic Protection**
Research to develop guidelines for cathodic protection of concentric neutral cables. Interim report, 6:33280 (EPRI-EL—1970(Vol.1))
Research to develop guidelines for cathodic protection of concentric neutral cables. Interim report, 6:33281 (EPRI-EL—1970(Vol.2))
**Design**
Laboratory development of +-600 kV dc pipe cable system, 6:33284
**Failures**
Conductor fatigue-life research. Final report, 6:33278 (EPRI-EL—1946)
**Fatigue**
Conductor fatigue-life research. Final report, 6:33278 (EPRI-EL—1946)
**ELECTRIC CHARGES**
**Topology**
Topological theory of electric charge, 6:33982
**ELECTRIC CONTROLLERS**
**Noise**
Evaluation of the SCR controller noise problem, 6:33491 (SAND—81-1814C)
**ELECTRIC GENERATORS**
*(Rotating generators only; excludes DIRECT ENERGY CONVERTERS.)*
*See also TURBOGENERATORS*
**Rings**
High strength austenitic alloys for generator retaining rings, 6:33527 (LBL—12000)
**ELECTRIC POWER**
**Consumption Rates**
National Interim Energy-Consumption Survey: exploring the variability in energy consumption, 6:33449 (DOE/EIA—0272)
**Demand Factors**
Models for forecasting energy use in the US farm sector. Final report, 6:33470 (EPRI-EA—1956(Vol.1))
**Market**
ORNL rural electric-energy-demand forecasting model, 6:33427 (ORNL/TM—7863)
**ELECTRIC POWER INDUSTRY**
**Research Programs**
Proceedings: workshop on cycling and effects of toxic substances, Carmel, California, October 26-29, 1980, 6:33794 (EPRI-EA—1988)
**ELECTRIC UTILITIES**
**Financing**
New perspectives on public power, 6:33428
**Load Analysis**
Regional load-curve models: scenario and forecast using the DRI model. Final report (Forecasts of electric power loads in 32 US regions), 6:33422 (EPRI-EA—1672(Vol.3))
Regional load-curve models: QUERI's model specification, estimation and validation. Final report, 6:33421 (EPRI-EA—1672(Vol.2))
**Load Management**
Selective load control for industrial customers, 6:33264 (ORNL/Sub—7399/1)
**Planning**
New perspectives on public power, 6:33428
**Rate Structure**
Energy management programs for commercial & industrial customers: panel presentation, 6:33431
Price regulation and energy policy, 6:33430
**Regulations**
Price regulation and energy policy, 6:33430
**Waste Management**
Solid-waste impacts of increased coal utilization, 6:32865 (BNL—24786)
**ELECTRICAL INSULATORS**
**Aging**
Aging of Adiprene L-100/butanediol/trimethylolpropane stocks, 6:33069 (GEPP-TIS—587)
**Crystal-Phase Transformations**
Recent advances in the study of structural phase transitions at high pressure, 6:34046 (SAND—81-1151C)
**Flashover**
Contamination flashover of HVDC insulators. Final report, 6:33282 (EPRI-EL—2016)
**Jahn-Teller Effect**
Recent advances in the study of structural phase transitions at high pressure, 6:34046 (SAND—81-1151C)
**ELECTRIC-POWERED VEHICLES**
**Aluminium-Air Batteries**
Development of the aluminum-air battery for electric vehicle applications, 6:33492 (UCRL—86560)
**Electric Controllers**
Evaluation of the SCR controller noise problem, 6:33491 (SAND—81-1814C)
**Feasibility Studies**
Feasibility of electric vehicles in New Zealand, 6:33493
**ELECTROCATALYSTS**
**Fabrication**
Preparation and evaluation of advanced electrocatalysts for phosphoric acid fuel cells. Sixth quarterly report, April-June 1981, 6:33440 (DOE/NASA/0176—81/2)
**Performance Testing**
Preparation and evaluation of advanced electrocatalysts for phosphoric acid fuel cells. Sixth quarterly report, April-June 1981, 6:33440 (DOE/NASA/0176—81/2)
**ELECTROCHEMICAL CELLS**
*See also ELECTRIC BATTERIES*
*PHOTOELECTROCHEMICAL CELLS*
**Evaluation**
Electrochemical gasification of coal--simultaneous production of hydrogen and carbon dioxide by a single reaction involving coal, water, and electrons, 6:32850
**Reviews**
Review of thermally regenerative electrochemical systems, 6:33442 (SERI/TR—332-416-Vol.2)
**ELECTROCHEMICAL MACHINING**
**Electrodes**
Tooling for electrochemical deburring. Topical report, 6:33629 (BDX—613-2644)
**Tools**
Tooling for electrochemical deburring. Topical report, 6:33629 (BDX—613-2644)
**ELECTROCHEMISTRY**
**Peaks**
Nuclear waste management, 6:33589 (LBL—12000)
**ELECTRODES**
**Chemical Reactions**
Fossil energy, 6:32862 (LBL—12000)
**Design**
Electrode design and performance of the ORNL positive ion sources, 6:34181 (ORNL/TM—7879)

**Hydrodynamics**
Improvements on computer simulation of electrochemical phenomena involving hydrodynamics: the rotating disk and the dropping mercury electrode, 6:33611
**Materials**
Oxidation of formic acid and methanol on single crystal platinum electrodes, 6:33605 (BNL—29817)
**Morphology**
Investigation of the zinc electrode reaction. Annual report, October 1, 1979-September 30, 1980, 6:33377 (BNL—51370)
**Surfaces**
Determination of surface inhomogeneities qfing a scanning probe impedance technique, 6:33610
**Temperature Distribution**
On heat balance in coal-fired MHD systems, channel heat transfer and electrode temperature distribution, 6:33437

**ELECTROLYTE TILES**
*See MATRIX MATERIALS*

**ELECTROLYTES**
**Evaluation**
Use of alkali metal-acid phosphates for elevated temperature water electrolysis, 6:33077 (UCRL—86623)
**Research Programs**
Improved beta-alumina electrolytes for advanced storage batteries, 6:33379 (LBL—12000)
**Thermodynamic Activity**
Thermodynamics of electrolytes. IV. Activity and osmotic coefficients for mixed electrolytes, 6:33602

**ELECTROMAGNETIC INTERACTIONS**
*See also ELECTROPRODUCTION*
**Topology**
Topological theory of electric charge, 6:33982

**ELECTRON COLLISIONS**
**Bremsstrahlung**
Bremsstrahlung energy spectra from electrons of kinetic energy 1 keV $\leqq$ T $\leqq$ 2000 keV incident on neutral atoms 1 $\leqq$ Z $\leqq$ 92, 6:33959 (SAND—81-1337)

**ELECTRON GUNS**
**Design**
ORELA electron guns, 6:33672 (ORNL/TM—7886)
**Performance**
ORELA electron guns, 6:33672 (ORNL/TM—7886)

**ELECTRON MICROPROBE ANALYSIS**
**Sample Changers**
Automation of a specimen stage in an electron microprobe. Final report, 6:33696 (BDX—613-2668)

**ELECTRON REACTIONS**
**Elastic Scattering**
Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)
**Inelastic Scattering**
Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)

**ELECTRON SOURCES**
**Design**
Radiation source (Patent), 6:34191

**ELECTRON-BEAM-PUMPED LASERS**
*See FREE ELECTRON LASERS*

**ELECTRONS**
**Pair Production**
Two-photon contributions to lepton production in pp scattering, 6:33980
**Scavenging**
Laser-induced photoelectrochemistry: scavenging of photoemitted electrons in aqueous and non-aqueous solutions by electroactive organic species, 6:33614

**ELECTROPLATING**
Apparatus for electroplating particles of small dimension (Patent), 6:33567
**Research Programs**
Energy storage, 6:33378 (LBL—12000)

**ELECTROPRODUCTION**
**Flavor Model**
Heavy quarks in electroproduction, 6:33978
**Structure Functions**
Heavy quarks in electroproduction, 6:33978

**ELECTROREFINING**
**Research Programs**
Energy storage, 6:33378 (LBL—12000)

**ELECTROSTATIC LENSES**
**Design**
Design features and focal properties of simple three element two- or three-dimensional lens systems for decelerating intense ion beams to very low energies, 6:33668

**ELECTROSTATIC PRECIPITATORS**
**Design**
Collection efficiencies of a point-to-plane electrostatic precipitator, 6:33704
**Mechanical Efficiency**
Collection efficiencies of a point-to-plane electrostatic precipitator, 6:33704

**ELEMENTS**
*See also METALS*
*TRANSURANIUM ELEMENTS*
**Environmental Transport**
Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)
**Geochemistry**
Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)

**ELMO BUMPY TORUS**
**Beta Ratio**
Beta limits in EBT and their implications for a reactor, 6:34065 (ORNL/TM—7857)
**Design**
Design studies of commercial magnetic fusion reactors, 6:34170 (CONF-801011—(Vol.3))
ELMO Bumpy Torus Reactor, 6:34165 (CONF-801011—(Vol.3))
**Energy Balance**
Simple-power-balance model for microwave heating in EBT, 6:34064 (ORNL/TM—7001)

**EMBRYONIC CELLS**
**Oncogenic Transformations**
How and why of in vitro oncogenic transformation (X-rays: $^{60}$Co), 6:33894

**END USE SECTOR**
*See INDUSTRY*

**ENERGY**
*See also GEOTHERMAL ENERGY*
*SOLAR ENERGY*
Technology characterizations: environmental information handbook. Second edition, 6:33840 (DOE/EP—0028)
**Environmental Impacts**
Energy technologies and the environment: environmental information handbook, 6:33839 (DOE/EP—0026)
**Technology Assessment**
Energy technologies and the environment: environmental information handbook, 6:33839 (DOE/EP—0026)

**ENERGY ANALYSIS**
Selected studies on energy; background papers for energy: the Next Twenty Years, 1980, 6:33400
**Computer Codes**
DOE-2.1 building energy analysis group, 6:33455 (LBL—11985)

**ENERGY CONSERVATION**
Price regulation and energy policy, 6:33430
Selected studies on energy; background papers for energy: the Next Twenty Years, 1980, 6:33400
**Meetings**
Information for decisionmakers. Energy conservation in industry and Department of Energy facilities, 6:33444 (CONF-7803136—)
**Program Management**
Annual report to the President and the Congress on the State Energy Conservation Program for calendar year 1980, 6:33394 (DOE/CE—0016)
**Public Relations**
Energy management programs for commercial & industrial customers: panel presentation, 6:33431

**Weatherization**
Energy savings from the Minnesota low-income weatherization programme, 6:33397
**ENERGY CONSUMPTION**
Determination of specific consumption of raw materials and energy in the chemical industry, 6:33472
Dimensions of energy demand (Options for changing growth), 6:33402
**Data Analysis**
National Interim Energy-Consumption Survey: exploring the variability in energy consumption, 6:33449 (DOE/EIA—0272)
**Surveys**
National Interim Energy-Consumption Survey: exploring the variability in energy consumption, 6:33449 (DOE/EIA—0272)
**ENERGY DEMAND**
Dimensions of energy demand (Options for changing growth), 6:33402
**Economic Impact**
Energy in America: fifteen views, 6:32984
**ENERGY EFFICIENCY**
**Research Programs**
Energy efficiency buildings program, FY 1980, 6:33450 (LBL—11985)
**ENERGY EFFICIENCY STANDARDS**
**Economic Impact**
Potential environmental issues related to building energy performance standards, 6:33447 (DOE/CS/20205—T17)
**Environmental Impacts**
Potential environmental issues related to building energy performance standards, 6:33447 (DOE/CS/20205—T17)
**Social Impact**
Potential environmental issues related to building energy performance standards, 6:33447 (DOE/CS/20205—T17)
**ENERGY MANAGEMENT**
**Public Relations**
Energy management programs for commercial & industrial customers: panel presentation, 6:33431
**ENERGY MODELS**
Application of an LP model to strategic planning of multinational cooperative RD and D programs (MARKAL), 6:33387 (BNL—29857)
Methodology and basic algorithms of the Livermore Economic Modeling System, 6:33383 (UCRL—53131)
Models for forecasting energy use in the US farm sector. Final report, 6:33470 (EPRI-EA—1956(Vol.1))
Regional load-curve models: QUERI's model specification, estimation and validation. Final report, 6:33421 (EPRI-EA—1672(Vol.2))
**ENERGY POLICY**
Energy technologies and the environment: environmental information handbook, 6:33839 (DOE/EP—0026)
Institutional obstacles to industrial cogeneration, 6:33393
Methodology and basic algorithms of the Livermore Economic Modeling System, 6:33383 (UCRL—53131)
Price regulation and energy policy, 6:33430
**Economic Analysis**
Electric utilities face the next twenty years, 6:33429
**Economics**
Selected studies on energy; background papers for energy: the Next Twenty Years, 1980, 6:33400
**ENERGY SECURITY CORPORATION**
*See SYNTHETIC FUELS CORPORATION*
**ENERGY SHORTAGES**
**Emergency Plans**
Preparing for an oil crisis: elements and obstacles in crisis management, 6:33403
**ENERGY SOURCE DEVELOPMENT**
*See also SYNTHETIC FUELS CORPORATION*
**Economics**
Energy in America: fifteen views, 6:32984
Selected studies on energy; background papers for energy: the Next Twenty Years, 1980, 6:33400
**Environmental Impacts**
Archaeological, historical, and cultural resources, 6:33834 (DOE/EP/10012—1)
Land resources, 6:33808 (DOE/EP/10012—1)
Technology characterizations: environmental information handbook. Second edition, 6:33840 (DOE/EP—0028)
Wildlife, 6:33843 (DOE/EP/10012—1)
**Political Aspects**
Energy in America: fifteen views, 6:32984
**Risk Assessment**
Assessing environmental risks of energy, 6:33837
**Technology Assessment**
Energy in America: fifteen views, 6:32984
**ENERGY SOURCES**
*See also FOSSIL FUELS*
*NUCLEAR FUELS*
*RENEWABLE ENERGY SOURCES*
*WIND POWER*
*WOOD FUELS*
**Education**
Energy future: a primer for secondary school teachers, 6:33483 (BNL—51381)
**Environmental Impacts**
Distributed energy systems in California's future: Interim report, Volume I, 6:33399 (LBL—6831-Rev.)
**Socio-Economic Factors**
Distributed energy systems in California's future: Interim report, Volume I, 6:33399 (LBL—6831-Rev.)
**ENERGY STORAGE SYSTEMS**
*See also COMPRESSED AIR ENERGY STORAGE EQUIPMENT*
*ELECTRIC BATTERIES*
*THERMAL ENERGY STORAGE EQUIPMENT*
**Redox Fuel Cells**
Preparation and characterization of electrodes for the NASA Redox storage system, 6:33441 (DOE/NASA/12726—13)
**ENERGY SUPPLIES**
*See also FUEL SUPPLIES*
**Global Aspects**
Our energy world energy in review, 6:33401
**Prices**
Energy in America: fifteen views, 6:32984
**ENERGY SYSTEMS**
**Research Programs**
Application of an LP model to strategic planning of multinational cooperative RD and D programs (MARKAL), 6:33387 (BNL—29857)
**ENGINEERED SAFETY SYSTEMS**
**Erosion**
Stability of multilayer earthen barriers used to isolate mill tailings: geologic and geotechnological considerations, 6:33040 (PNL—3902)
**Seismic Effects**
Stability of multilayer earthen barriers used to isolate mill tailings: geologic and geotechnological considerations, 6:33040 (PNL—3902)
**ENGLAND**
*See UNITED KINGDOM*
**ENHANCED RECOVERY**
**Cogeneration**
Cogeneration potential: enhanced oil recovery. Final report, 6:32970 (EPRI-EM—1996)
**Comparative Evaluations**
Economics of enhanced oil recovery and its position relative to synfuels, 6:32976
**Cost**
Economics of enhanced oil recovery and its position relative to synfuels, 6:32976
**Data Base Management**
Relational methodology for integrating and analyzing field test and research data describing enhanced oil recovery, 6:32967 (DOE/ET/10145—72)
**ENOLS**
**Electronic Structure**
Stereoelectronic properties of photosynthetic and related systems. 10. Quantum mechanical characterization of the excited states of ethyl chlorophyllide α enol, 6:33609
**ENRICHED URANIUM**
**Availability**
Uranium enrichment: response to an energy crisis, 6:33017
**Nondestructive Analysis**
Application of the active well coincidence counter (AWCC) to high-enrichment uranium metal, 6:33060 (LA—8621-MS)

**ENVIRONMENT**
Technology characterizations: environmental information handbook. Second edition, 6:33840 (DOE/EP—0028)
**Manuals**
Energy technologies and the environment: environmental information handbook, 6:33839 (DOE/EP—0026)
**ENVIRONMENTAL EXPOSURE CHAMBERS**
*See EXPOSURE CHAMBERS*
**ENVIRONMENTAL IMPACTS**
Findings supporting determination related to international nuclear power export activities pending preparation of a section 102(2)(C) NEPA environmental statement, 6:33290 (ERDA—80)
Nuclear energy center conceptual study. Phase III: site specific evaluation. Topical report, environmental, 6:33335 (DOE/OR/06074—1-Vol.3)
**ENVIRONMENTAL MATERIALS**
**Activation Analysis**
Environmental trace element analysis using short-lived nuclides, 6:33732 (CONF-800433—)
Neutron activation analysis without multi-element standards, 6:33731 (CONF-800433—)
**Chemical Analysis**
Nuclear methods in environmental and energy research, 6:33784 (CONF-800433—)
**Isotope Dating**
Laser isotope dating: a new technique of radioisotope dating using lasers, 6:33791 (CONF-800433—)
**Multi-Element Analysis**
Activation-analysis prospects by using a concentric 5 x $10^{12}$ N/S sealed neutron tube combined with a fast rabbit system, 6:33730 (CONF-800433—)
Activation analysis with short lived nuclides in environmental research, 6:33735 (CONF-800433—)
Environmental trace element analysis using short-lived nuclides, 6:33732 (CONF-800433—)
Ultra-sensitive trace element analysis of environmental samples using advanced TRXRF techniques, 6:33815 (CONF-800433—)
Use of a synchrotron radiation x-ray microprobe for elemental analysis at the national synchrotron light source, 6:33790 (CONF-800433—)
Use of neutron-capture prompt gamma-ray activation analysis in environmental and energy research, 6:33806 (CONF-800433—)
**PIXE Analysis**
PIXE analysis of biological and environmental samples using a proton microprobe, 6:33734 (CONF-800433—)
**ENVIRONMENTAL POLICY**
Energy technologies and the environment: environmental information handbook, 6:33839 (DOE/EP—0026)
**Information Systems**
Managing large-scale models: DBS, 6:33384 (DOE/EP—0006)
**ENVIRONMENTAL TRANSPORT**
*See also RADIONUCLIDE MIGRATION*
**Mathematical Models**
Soil homogeneity evaluation by radionuclide tracer breakthrough curve interpretation, 6:33819 (CONF-800433--)
**ENZYME INHIBITORS**
**Radiosensitivity Effects**
Influence of noncarcinogenic secondary factors on radiation carcinogenesis (In vitro; hamsters; x ray), 6:33896
**EOR**
*See ENHANCED RECOVERY*
**EPOXIDES**
**Curing**
Effect of network structure on moisture absorption of epoxy resins, 6:33607
**Sorptive Properties**
Effect of network structure on moisture absorption of epoxy resins, 6:33607
**EPOXY COMPOUNDS**
*See EPOXIDES*
**EPSTEIN-BARR VIRUS**
*See ONCOGENIC VIRUSES*
**EQUILIBRIUM PLASMA**
**Algorithms**
Algorithms developed to obtain particular numerical solutions to the ideal MHD equilibrium problem, 6:34058 (GA-A—16400)
**Magnetohydrodynamics**
Algorithms developed to obtain particular numerical solutions to the ideal MHD equilibrium problem, 6:34058 (GA-A—16400)
**ERBIUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**ERBIUM 162 TARGET**
**Triton Reactions**
Nuclear structure of $^{161}$sup(,)$^{163}$Ho studied with the (t vector,α) reaction, 6:34022
**ERBIUM 164 TARGET**
**Triton Reactions**
Nuclear structure of $^{161}$sup(,)$^{163}$Ho studied with the (t vector,α) reaction, 6:34022
**ERBIUM 168**
**Energy Levels**
Identification of all intrinsic excitations below 2 MeV in $^{168}$Er, 6:34023
**EROSION**
**Reviews**
Indentation and erosion of brittle materials, 6:33548 (LBL—11883)
**ERUPTIVE VARIABLE STARS**
**Pulsations**
Pulsations of the R Coronae Borealis stars, 6:33943
**ERYTHROCYTES**
**Sensitivity**
Diminished osmotic fragility of human erythrocytes following the membrane insertion of oxygenated sterol compounds, 6:33855
**ESCHERICHIA COLI**
**Biological Radiation Effects**
Analysis of resynthesis tracts in repaired Escherichia coli deoxyribonucleic acid, 6:33899
Cytoplasmic membrane fraction that promotes septation in an Escherichia coli Ion mutant, 6:33898
**Genetic Radiation Effects**
Comparative mutagenesis and interaction between near-ultraviolet (313- to 405-nm) and far-ultraviolet (254-nm) radiation in Escherichia coli strains with differing repair capabilities, 6:33900
**ESTUARINE ECOSYSTEMS**
*See AQUATIC ECOSYSTEMS*
**ETHANOL**
**Solvent Extraction**
Distribution of ethanol-water mixtures to organic liquids, 6:33087
**ETHERS**
*See also ACETALS*
**Chemical Reactions**
Exploratory study of coal-conversion chemistry. Quarterly report No. 9, March 20, 1980-June 19, 1980 (Hydroxydiphenylmethane, diphenylether, diphenymethane), 6:32816 (DOE/ET/14855—9)
Exploratory study of coal-conversion chemistry. Quarterly report, June 20, 1980-September 19, 1980 (Diphenylmethane, diphenyl ether), 6:32817 (DOE/ET/14855—12)
**Ion-Molecule Collisions**
Gas-phase reactions of $Fe^+$ with ketones and ethers, 6:33960
**ETHINE**
*See ACETYLENE*
**ETHNIC GROUPS**
*See MINORITY GROUPS*
**ETHYLENE**
**Purification**
Hydrogenation or recovery of acetylene: an economic comparison, 6:32978

**ETHYLENE CARBOXYLIC ACID**
*See ACRYLIC ACID*
**ETHYNE**
*See ACETYLENE*
**EUROPIUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**EXCAVATORS**
*See EARTHMOVING EQUIPMENT*
**EXHAUST GASES**
**Chemical Composition**
Liquid-liquid chromatography fractionation of organic compounds in complex mixtures: application to automobile exhaust, 6:33575 (IS-T—914)
**Thermal Analysis**
Model for the progressive combustion analysis of carbonaceous aerosol particles, 6:33756 (LBL—11986)
**EXPERIMENTAL BREEDER REACTOR-2**
*See EBR-2 REACTOR*
**EXPLODING WIRES**
**Computerized Simulation**
Computer modeling of an all-secondary explosive hot-wire device, 6:33708 (LA—8930-MS)
**EXPLOSIVE FRACTURING**
**Mathematical Models**
Small-scale experiments with an analysis to evaluate the effect of tailored pulse loading on fracture and permeability. Final report for Phase II, June 11, 1980-June 11, 1981, 6:32992 (DOE/MC/11577—T23)
**EXPOSURE CHAMBERS**
**Control Systems**
Microcomputer-controlled communication network for Sandia National Laboratories' environmental test chambers, 6:33701 (SAND—81-1782)
**Data Acquisition Systems**
Microcomputer-controlled communication network for Sandia National Laboratories' environmental test chambers, 6:33701 (SAND—81-1782)
**Design**
Oxidation of $SO_2$ by wet soot particles: application to clouds, fogs, and plumes, 6:33748 (LBL—11986)
**EXXON GASIFICATION PROCESS**
**Separation Processes**
Cryogenic methane separation/catalytic hydrogasification process analysis. Quarterly report, 6:32811 (DOE/ET/10325—T11)

## F

**FABRIC FILTERS**
**Cost**
Particulate control for industrial coal fired boilers: the reverse gas fabric filter method, 6:32879
**Evaluation**
Particulate control for industrial coal fired boilers: the reverse gas fabric filter method, 6:32879
**Operation**
Particulate control for industrial coal fired boilers: the reverse gas fabric filter method, 6:32879
**FACILITIES (NUCLEAR)**
*See NUCLEAR FACILITIES*
**FACILITIES (RESOURCE RECOVERY)**
*See RESOURCE RECOVERY FACILITIES*
**FACILITIES (TEST)**
*See TEST FACILITIES*
**FALLOUT**
*(For radioactive fallout only.)*
**Deposition**
Results of calculations of external gamma-radiation exposure rates from fallout and the related radionuclide compositions. Operation Ranger, 1951, 6:33805 (UCRL—53152-Pt.1)
**Dose Rates**
Results of calculations of external gamma-radiation exposure rates from fallout and the related radionuclide compositions. Operation Ranger, 1951, 6:33805 (UCRL—53152-Pt.1)
**FAR ULTRAVIOLET RADIATION**
*(Wavelength range 2000-400 A.)*
**Mutagenesis**
Comparative mutagenesis and interaction between near-ultraviolet (313- to 405-nm) and far-ultraviolet (254-nm) radiation in Escherichia coli strains with differing repair capabilities, 6:33900
**FARMS**
**Wind Turbines**
Project demonstration of wind-turbine electricity: interconnecting a northern Michigan fruit farm with a major utility, 6:33242 (DOE/R5/10226—1)
**FAST BREEDER TYPE REACTORS**
*See FBR TYPE REACTORS*
**FAST FLUX TEST FACILITY REACTOR**
*See FFTF REACTOR*
**FBR TYPE REACTORS**
*See also GCFR TYPE REACTORS*
*LMFBR TYPE REACTORS*
*ZEBRA REACTOR*
**Fuel Element Failure**
Modeling deformation and failure of fast reactor cladding during simulated accident transients, 6:33365
**Transients**
Modeling deformation and failure of fast reactor cladding during simulated accident transients, 6:33365
**FEDERAL BUILDINGS**
**Energy Conservation**
Information for decisionmakers. Energy conservation in industry and Department of Energy facilities, 6:33444 (CONF-7803136—)
**Solar Air Conditioning**
Commercialization survey for the Department of Energy's solar buildings demonstration program, 6:33191 (DOE/SF/11446—T1)
**Solar Space Heating**
Commercialization survey for the Department of Energy's solar buildings demonstration program, 6:33191 (DOE/SF/11446—T1)
**FEDERAL REPUBLIC OF GERMANY**
**Radioactive Waste Processing**
Storage and solidification of MAW/LAW in underground caverns (Phase 2). Studies on product conveyance in fall pipelines. Reporting period, July 1, 1979-December 31, 1979, 6:33020 (ORNL-tr—4777)
**Underground Mining**
Emphasis in overseas research on underground coal mining: geomechanical implications (Australian report), 6:32904 (CSIRO—2)
**FERMILAB ACCELERATOR**
**Storage Rings**
State of the energy doubler, 6:33675
**Superconducting Magnets**
Room temperature harmonic analysis of superconducting energy saver quadrupoles, 6:33674
State of the energy doubler, 6:33675
Two cell double systems test, 6:33676
**FERMIUM**
**Chemical Properties**
Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:33624
**Chemistry**
Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:33624
**FERRATES**
*See IRON OXIDES*
**FERROELECTRIC MATERIALS**
**Neutron Diffraction**
Neutron scattering studies of quasi one- and two-dimensional hydrogen-bonded ferroelectrics, 6:34037 (BNL—30004)

**Photosensitivity**
Effects of ion implantation on the photoferroelectric properties of lead lanthanum zirconate titanate ceramics, 6:33561 (SAND—81-1834C)
**FERTILE MATERIALS**
*(Materials containing nuclides capable of being transformed into fissile nuclides by neutron capture.)*
**Neutron Reactions**
PAPIN: A Fortran-IV program to calculate cross section probability tables, Bondarenko and transmission self-shielding factors for fertile isotopes in the unresolved resonance region, 6:34028 (ORNL/TM—7883)
**FFTF REACTOR**
Utilizing FFTF: the keystone for breeder development, 6:33311 (HEDL-SA—2386)
**Fuel Assemblies**
Analysis of in-core coolant temperatures of FFTF instrumented fuels tests at full power, 6:33337 (HEDL-SA—2330-Rev.1)
**In Core Instruments**
Analysis of in-core coolant temperatures of FFTF instrumented fuels tests at full power, 6:33337 (HEDL-SA—2330-Rev.1)
Automated remote positioning and examination of FFTF reactor power characterization dosimeters, 6:33336 (HEDL-SA—2312-FP)
**Reactor Materials**
Empirical development of irradiation-induced swelling design equations, 6:33340
**Reactor Start-Up**
Startup of the FFTF sodium cooled reactor (Acceptance Test Program), 6:33310 (HEDL-SA—2371)
**Remote Handling Equipment**
Automated remote positioning and examination of FFTF reactor power characterization dosimeters, 6:33336 (HEDL-SA—2312-FP)
**Spent Fuel Casks**
Heat transfer in a fuel pin shipping container (IDENT 1578), 6:33635 (HEDL-SA—2201-FP)
**FIBER OPTICS**
Streak camera measurements of laser pulse temporal dispersion in short graded-index optical fibers, 6:34185 (UCID—19176)
**Design**
Fine-grained hodoscopes based on scintillating optical fibers, 6:33686 (BNL—29923)
**FIBERS**
**Inhalation**
Method of determining glass in rat lung after exposure to a glass fiber aerosol, 6:33914
**FIBROBLASTS**
**Biological Radiation Effects**
Influence of noncarcinogenic secondary factors on radiation carcinogenesis (In vitro; hamsters; x ray), 6:33896
**Oncogenic Transformations**
How and why of in vitro oncogenic transformation (X-rays: $^{60}$Co), 6:33894
**Sensitivity**
Sensitivity of excision repair in normal human, xeroderma pigmentosum variant and Cockayne's syndrome fibroblasts to inhibition by cytosine arabinoside, 6:33893
**FIELD-REVERSED MIRROR REACTORS**
**Breeding Blankets**
Moving ring field-reversed mirror blanket design considerations, 6:34146 (CONF-801011—(Vol.3))
**Design**
Conceptual design of a compact field reversed mirror reactor: SAFFIRE, 6:34149 (CONF-801011—(Vol.3))
Moving-ring field-reversed mirror reactor, 6:34151 (CONF-801011—(Vol.3))
**FILLING STATIONS**
*See GASOLINE SERVICE STATIONS*
**FIRE STATIONS**
*See PUBLIC BUILDINGS*
**FIREBALLS**
**Size**
High-explosive detonations in varying-oxygen atmospheres, 6:33716 (UCRL—86563)
**FIREDAMP**
*See METHANE*
**FIREWOOD**
*See WOOD FUELS*
**FIRST WALL**
**Blisters**
Surface radiation damage in molybdenum alloys irradiated, 6:34127 (CONF-801011—(Vol.2))
**Design**
First-wall/blanket design for the STARFIRE tokamak reactor, 6:34143 (CONF-801011—(Vol.3))
**Feasibility Studies**
Stability of the lithium waterfall first wall protection concept for inertial confinement fusion reactors, 6:34140 (CONF-801011—(Vol.3))
**Materials Testing**
Critical materials problems in INTOR, 6:34129 (CONF-801011—(Vol.2))
**Test Facilities**
Electric field bumpy torus plasma as a test bed for plasma-wall interaction studies, 6:34145 (CONF-801011—(Vol.3))
**FISCHER-TROPSCH SYNTHESIS**
Processes and techniques, 6:32839 (LBL—12000)
**Catalysts**
Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)
**Chemical Reactors**
Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)
**Research Programs**
Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)
**FISHES**
**Agglutinins**
Agglutinating antibody to Aeromonas hydrophila in wild largemouth bass, 6:33877
**Radioactivity**
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)
Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)
**Survival Time**
Studies on toxicity of OTEC plant components on marine animals from the Gulf of Mexico. Final report, September 1, 1978-November 30, 1980, 6:33909 (DOE/ET/20512—T1)
**FISSION**
Angular momentum effects in fusion-fission and fusion-evaporation reactions, 6:34035
**FISSION FRAGMENTS**
**Kinetic Energy**
Kinetic energy deficit in the symmetric fission of $^{259}$Md, 6:34030
**FISSION NEUTRONS**
**Carcinogenesis**
Experimental radiation carcinogenesis: what have we learned ($^{60}$Co; fission neutrons; mice), 6:33895
**FISSION PRODUCTS**
**Radiation Monitoring**
Evaluation of airborne radioactive Iodine and noble gas environmental monitors using short-lived research reactor-produced radionuclides, 6:33765 (CONF-800433—)
**Radioactive Waste Disposal**
In situ determination of transuranic and fission product radionuclides, 6:33798 (CONF-800433—)
**FISSIONABLE MATERIALS MANAGEMENT**
*See NUCLEAR MATERIALS MANAGEMENT*
**FISSURED FORMATIONS**
*See FRACTURED RESERVOIRS*
**FLASH HYDROPYROLYSIS PROCESS**
**Bench-Scale Experiments**
Flash hydropyrolysis of Western Kentucky No. 9 bituminous coal with catalysts. Final technical progress report, 6:32818 (DOE/ET/14943—T1)

**Catalysts**
Flash hydropyrolysis of Western Kentucky No. 9 bituminous coal with catalysts. Final technical progress report, 6:32818 (DOE/ET/14943—T1)
**Yields**
Flash hydropyrolysis of Western Kentucky No. 9 bituminous coal with catalysts. Final technical progress report, 6:32818 (DOE/ET/14943—T1)

**FLAT PLATE COLLECTORS**
**Thermocouples**
An investigation of the use of thermocouples in solar collectors to produce electricity, 6:33194 (DOE/R5/10223—2)

**FLOORS**
**Mechanical Properties**
Geomechanical considerations related to the choice of a working floor for a proposed longwall development, 6:32921

**FLORIDA**
**Resource Recovery Facilities**
Advanced system experimental facility: solid waste to methane gas. Background and process description, 6:33079 (ANL/CNSV—22)

**FLOW (FLUID)**
*See FLUID FLOW*

**FLOW MODELS**
Development of an explicit finite-difference fluid flow model (STEALTH 2D code), 6:33922 (LBL—11566)
Porous media fluid flow, heat, and mass transport model with rock stress coupling (GWTHERM flow model), 6:33052 (LBL—11566)
**Uses**
Numerical model CCC, 6:33212 (LBL—11566)

**FLUE GAS**
**Air Pollution Abatement**
Evaluation of dry alkalis for removing sulfur dioxide from boiler flue gases. Final report, 6:33270 (EPRI-FP—207)
**Chemical Analysis**
Automated on-line determination of PPB levels of sodium and potassium in low-Btu coal gas and fluidized bed combustor exhaust by atomic emission spectrometry, 6:32861 (IS-M—330)
**Chemical Composition**
Elemental composition of atmospheric fine-particles emitted from coal burned in a modern electric power plant equipped with a flue-gas desulfurization system, 6:33762 (UCRL—85035)
**Denitrification**
Kinetics of reactions in a wet flue-gas simultaneous desulfurization and denitrification system, 6:32878 (LBL—13063)
**Desulfurization**
Elemental composition of atmospheric fine-particles emitted from coal burned in a modern electric power plant equipped with a flue-gas desulfurization system, 6:33762 (UCRL—85035)
Evaluation of dry alkalis for removing sulfur dioxide from boiler flue gases. Final report, 6:33270 (EPRI-FP—207)
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
Kinetics of reactions in a wet flue-gas simultaneous desulfurization and denitrification system, 6:32878 (LBL—13063)
Preliminary study: use of low-sulfur coal and coal cleaning in control of acid rain, 6:32866 (DOE/MC/14784—T1)
**Sampling**
Survey of particulate emission macro- and micro-sampling and sizing methods and real-time monitoring and sizing methods, 6:33742 (DOE/FC/10193—T1)

**FLUID FLOW**
*See also GAS FLOW*
*SWIRL FLOW*
*TURBULENT FLOW*
**Flow Models**
Introduction to numerical modeling of thermohydrologic flow in fractured rock masses, 6:33048 (LBL—11566)
Program ROCMAS: introduction and user's guide, 6:33931 (LBL—12987)
**Mathematical Models**
Finite element method for coupled stress and fluid flow analysis of fractured rock masses, 6:33929 (LBL—11566)
Flow in fractured porous media, 6:33051 (LBL—11566)
Multidimensional numerical simulation of fluid flow in fractured porous media, 6:33050 (LBL—11566)
**Porous Materials**
Analysis of column tracer experiments by a stochastic-convective transport method, 6:33923 (PNL-SA—9478)
**Stochastic Processes**
Analysis of column tracer experiments by a stochastic-convective transport method, 6:33923 (PNL-SA—9478)

**FLUID MECHANICS**
*See also AERODYNAMICS*
*HYDRAULICS*
**Bibliographies**
Bibliography Group T-3, 1955-1980, 6:33962 (LALP—81-29)

**FLUIDIZED BED HEAT EXCHANGERS**
**Performance**
Fluid-bed heat-exchanger optimization and bed materials selection. Final report, 6:33467 (DOE/ET/11343—T2)

**FLUIDIZED BED REACTORS**
**Heat Exchangers**
Heat-supply system for a fluidized-bed reactor featuring an endothermic reaction, 6:32977

**FLUIDIZED-BED COMBUSTION**
**Demonstration Plants**
Tennessee Valley Authority plans to demonstrate FBC steam power generation from coal, 6:32949
**Pilot Plants**
Tennessee Valley Authority plans to demonstrate FBC steam power generation from coal, 6:32949

**FLUIDIZED-BED COMBUSTORS**
**Commercialization**
Evaluating R and D options under uncertainty. Volume 2. Atmospheric fluidized-bed combustion commercialization strategies. Final report, 6:33425 (EPRI-EA—1964-Vol.2)
**Computerized Simulation**
Tennessee Valley Authority atmospheric fluidized-bed combustor simulation interim annual report, January 1-December 31, 1980, 6:33265 (ORNL/TM—7847)
**Corrosion**
Corrosion data for uncooled alloys in the bed of an atmospheric fluidized-bed boiler, 6:33661
Studies of in-bed corrosion in a pressurized fluidized-bed combustor. Final report, 6:33660 (EPRI-CS—1935)
**Design**
Fluidized-bed-fired industrial boilers, 6:33663
**Environmental Effects**
Environmental R and D needs for advanced power plants, 6:32895
**Fuel Feeding Systems**
Coal and limestone feed testing for atmospheric fluidized bed combustion, 6:32948 (ORNL/TM—7724)
**Manufacturing**
Fluidized-bed-fired industrial boilers, 6:33663
**Materials**
Corrosion data for uncooled alloys in the bed of an atmospheric fluidized-bed boiler, 6:33661
**Materials Testing**
Corrosion data for uncooled alloys in the bed of an atmospheric fluidized-bed boiler, 6:33661
**Mathematical Models**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**Performance**
Tennessee Valley Authority atmospheric fluidized-bed combustor simulation interim annual report, January 1-December 31, 1980, 6:33265 (ORNL/TM—7847)
**Research Programs**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**Solid Wastes**
Development of potential uses for the residue from fluidized-bed-combustion processes. Quarterly technical progress report, March-May 1981, 6:33466 (DOE/ET/10415—T4)

**FLUORESCENCE SPECTROSCOPY**
Two-laser induced selective infrared-visible fluorescence for thin film analysis, 6:33584
**FLUORESCENT LAMPS**
**Research Programs**
Energy-efficient lighting program, 6:33454 (LBL—11985)
**FLUORIDES**
**Environmental Transport**
Analysis of fluorine contamination from industrial sources, 6:33907 (CONF-800433—)
**FLUORINE 19 TARGET**
**Neon 20 Reactions**
Two-proton correlation measurements in 800 and 400 MeV/nucleon heavy-ion reactions, 6:34008
**FLY ASH**
**Catalytic Effects**
Role of fly ash in the catalytic oxidation of $SO_2$, 6:33752 (LBL—11986)
**Chemical Composition**
Classification of coal by trace analysis using INAA-clusteranalysis and leaching of precipitator ash, 6:33780 (CONF-800433—)
Elemental composition of atmospheric fine-particles emitted from coal burned in a modern electric power plant equipped with a flue-gas desulfurization system, 6:33762 (UCRL—85035)
Evaluation of potential processes for recovery of metals from coal ash. Final report, 6:33469 (EPRI-CS—1992(Vol.1))
New approach for erosion prediction due to fly ash, 6:33267
Particulate emission characteristics of oil-fired urtility boilers, 6:32989 (EPRI-CS—1995)
**Dusts**
Control of the fugitive dust during the loading of trucks with western coal fly ash, 6:32894 (EPRI-WS—79-236)
**Ground Disposal**
Soil homogeneity evaluation by radionuclide tracer breakthrough curve interpretation, 6:33819 (CONF-800433—)
**Marine Disposal**
Coal waste artificial reef program, Phase 3. Volume 3. Engineering-economic evaluation of fixed coal waste block production and disposal. Final report, 6:32870 (EPRI-CS—2009(Vol.3))
**Materials Handling**
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)
Coal and ash handling in a typical industrial boiler plant, 6:33647
Control of the fugitive dust during the loading of trucks with western coal fly ash, 6:32894 (EPRI-WS—79-236)
Feeding dry fly ash without flooding and flushing, 6:32927 (EPRI-WS—79-236)
Oil ash handling case history, 6:32872 (EPRI-WS—79-236)
Survey of fly ash handling and removal systems; past, present and future practices and their effect on precipitator and baghouse reliability, 6:32871 (EPRI-WS—79-236)
**Materials Recovery**
Evaluation of potential processes for recovery of metals from coal ash. Final report, 6:33469 (EPRI-CS—1992(Vol.1))
**Multi-Element Analysis**
Feasibility of trace multielement analysis by 14-MeV neutron activation, 6:33787 (CONF-800433—)
Nuclear methods in coal research, 6:33776 (CONF-800433—)
Nuclear techniques for the on-line bulk analysis of coal, 6:33781 (CONF-800433—)
**Particle Size**
Particulate emission characteristics of oil-fired urtility boilers, 6:32989 (EPRI-CS—1995)
**Pneumatic Transport**
Pneumatic conveying of fly ash in the pulse phase, 6:32873 (EPRI-WS—79-236)
**Quantitative Chemical Analysis**
Substoichiometric isotope dilution analysis of tin in coal fly ash, 6:33737 (CONF-800433—)
**Recycling**
Salt-soda sinter process for recovering aluminum from fly ash (Patent), 6:32868
**Removal**
Survey of fly ash handling and removal systems; past, present and future practices and their effect on precipitator and baghouse reliability, 6:32871 (EPRI-WS—79-236)
**Transport**
Coal and ash handling in a typical industrial boiler plant, 6:33647
**Waste Disposal**
Ash disposal methods: Eastern and Western coal, 6:32876 (EPRI-WS—79-236)
**Waste Processing**
Feeding dry fly ash without flooding and flushing, 6:32927 (EPRI-WS—79-236)
**FLYWHEEL ENERGY STORAGE**
**Economic Analysis**
Flywheel storage for photovoltaics: an economic evaluation of two applications, 6:33129 (MIT-EL—80-002)
**FMIT LINAC**
**Neutron Emission**
Neutron environment in d + Li facilities, 6:34173 (HEDL-SA—2340FP)
**Reviews**
Status of FMIT, 6:34130 (CONF-801011—(Vol.2))
**FOOD**
*See also ANIMAL FEEDS*
*MILK*
*VEGETABLES*
**Radiation Monitoring**
Environmental monitoring in the vicinity of the Savannah River Plant. Annual report, 1980, 6:33801 (DPSPU—81-30-1)
**FOOD CHAINS**
**Radionuclide Migration**
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)
**FOOD INDUSTRY**
**Energy Conservation**
Handbook for energy conservation in food canning plants, 6:33465 (DOE/CS/40087—T1)
**Solar Process Heat**
Solar production of industrial process steam: TRW/ORE-Ida potato processing project, Phase I. Final report, 6:33163 (DOE/CS/32197—T1)
**FORECASTING**
Selected studies on energy; background papers for energy: the Next Twenty Years, 1980, 6:33400
**FOREST LITTER**
**Radioactivity**
Environmental concentration and migration of $^{129}I$, 6:33767 (PNL-SA—9140)
**FORMALDEHYDE**
**Energy Transfer**
Advanced isotope separation technology, 6:33612 (LBL—12000)
**FORMATES**
**Catalytic Effects**
Exploratory study of coal-conversion chemistry. Quarterly report, December 20, 1979-March 19, 1980, 6:32815 (DOE/ET/14855—6)
**FORMATION WATER**
*See INTERSTITIAL WATER*
**FORMIC ACID**
**Adsorption**
Oxidation of formic acid and methanol on single crystal platinum electrodes, 6:33605 (BNL—29817)
**Oxidation**
Oxidation of formic acid and methanol on single crystal platinum electrodes, 6:33605 (BNL—29817)
**FORT ST. VRAIN REACTOR**
*See VRAIN REACTOR*
**FOSSIL FUELS**
*See also COAL*
*NATURAL GAS*
*OIL SANDS*
*OIL SHALES*
*PEAT*
*PETROLEUM*
*SHALE OIL*

*SYNTHETIC FUELS*
**Research Programs**
Sensitivity analysis of project appraisal variables. Volume II. Additional variables and composite scenarios, 6:33405 (DOE/ET/15078—T9)
**FOSSIL-FUEL POWER PLANTS**
*See also ELECTRIC UTILITIES*
Evaluating R and D options under uncertainty. Volume 3. An electric-utility generation-expansion planning model. Final report, 6:33426 (EPRI-EA—1964(Vol.3))
**Acoustic Emission Testing**
Vibration signature analysis and acoustic-emmission monitoring at Brayton Point. Final report, 6:33262 (EPRI-CS—1938)
**Air Pollution Control**
Preliminary study: use of low-sulfur coal and coal cleaning in control of acid rain, 6:32866 (DOE/MC/14784—T1)
**Ashes**
Ash disposal methods: Eastern and Western coal, 6:32876 (EPRI-WS—79-236)
Cost of ash disposal, 6:32877 (EPRI-WS—79-236)
Design and operation of compact bottom ash basins for 500 MW of generating capacity, 6:32875 (EPRI-WS—79-236)
**Cogeneration**
Comparative economics of solar thermal central receivers, 6:33147 (SAND—81-8236)
**Economics**
Feasibility of the high temperature gas-cooled reactor for cogeneration of process steam and electric power for a large oil refinery, 6:33322 (DOE/ET/34222—1)
**Environmental Effects**
Design and implementation of a demonstration supplementary control system, 6:33271 (MIT-EL—80-033)
Elemental composition of atmospheric fine-particles emitted from coal burned in a modern electric power plant equipped with a flue-gas desulfurization system, 6:33762 (UCRL—85035)
Environmental R and D needs for advanced power plants, 6:32895
Meteorological Effects of Thermal Energy Releases (METER) program. Annual progress report, October 1979-September 1980, 6:33769 (ORNL/TM—7744)
Studies at Plant Bowen: rainfall modification and wetfall chemistry, 6:33722 (ORNL/TM—7744)
Studies at Plant Bowen: temperature/humidity plumes and condensate scavenging, 6:33759 (ORNL/TM—7744)
**Feasibility Studies**
Feasibility of the high temperature gas-cooled reactor for cogeneration of process steam and electric power for a large oil refinery, 6:33322 (DOE/ET/34222—1)
**Financing**
Evaluating R and D options under uncertainty. Volume 1. Pulverized-coal development strategies. Final report, 6:33424 (EPRI-EA—1964(Vol.1))
**Flue Gas**
Design and implementation of a demonstration supplementary control system, 6:33271 (MIT-EL—80-033)
Evaluation of dry alkalis for removing sulfur dioxide from boiler flue gases. Final report, 6:33270 (EPRI-FP—207)
Kinetics of reactions in a wet flue-gas simultaneous desulfurization and denitrification system, 6:32878 (LBL—13063)
Particulate emission characteristics of oil-fired urtility boilers, 6:32989 (EPRI-CS—1995)
Reactions of nitrogen oxides, ozone and sulfur in power plant plumes, 6:33744 (EPRI-EA—270)
Survey of fly ash handling and removal systems; past, present and future practices and their effect on precipitator and baghouse reliability, 6:32871 (EPRI-WS—79-236)
**Fluidized-Bed Combustors**
Evaluating R and D options under uncertainty. Volume 2. Atmospheric fluidized-bed combustion commercialization strategies. Final report, 6:33425 (EPRI-EA—1964-Vol.2)
**Fuel Feeding Systems**
In-plant coal handling, 6:32934 (EPRI-WS—79-236)
**Hybrid Systems**
Storage requirement definition study. final report, 6:33143 (NASA-CR—163882)
**Mechanical Vibrations**
Vibration signature analysis and acoustic-emmission monitoring at Brayton Point. Final report, 6:33262 (EPRI-CS—1938)
**Outages**
Bottom ash handling from the 50's to the 90's, 6:32874 (EPRI-WS—79-236)
Coal- and ash-handling systems reliability conference and workshop proceedings, 6:32925 (EPRI-WS—79-236)
Overview of major causes of pulverizer failures, 6:32935 (EPRI-WS—79-236)
**Petroleum Refineries**
Feasibility of the high temperature gas-cooled reactor for cogeneration of process steam and electric power for a large oil refinery, 6:33322 (DOE/ET/34222—1)
**Public Opinion**
Public perceptions of industrial risks: the context of public attitudes toward radioactive waste, 6:33382 (PNL—3799)
**Pulverizers**
Overview of major causes of pulverizer failures, 6:32935 (EPRI-WS—79-236)
**Solar Repowering**
Improved effectiveness of solar repowering in the utilities with high coal generation, 6:33140 (ATR—80(7873)-4)
**Solid Wastes**
Monitoring the fixed FGD sludge landfill, Conesville, Ohio. Phase II, 6:32869 (EPRI-CS—1984)
**Topping Cycles**
Program-management plan with critical-path definition for combustion augmentation with thermionic energy conversion (CATEC), 6:33438 (DOE/NASA/1062—9)
**Waste Management**
Coal waste artificial reef program, Phase 3. Volume 3. Engineering-economic evaluation of fixed coal waste block production and disposal. Final report, 6:32870 (EPRI-CS—2009(Vol.3))
Monitoring the fixed FGD sludge landfill, Conesville, Ohio. Phase II, 6:32869 (EPRI-CS—1984)
**FOUNDATIONS**
**Impedance**
Impedance characteristics of large tower footings to a 100$\mu$s wide square wave of current, 6:33285
**FRACTURED RESERVOIRS**
**Flow Models**
Proceedings of the workshop on numerical modeling of thermohydrological flow in fractured rock masses, 6:33047 (LBL—11566)
**Fluid Flow**
Role of numerical models in applications to thermohydrological flow in fracture rock masses, 6:33210 (LBL—11566)
**Heat Transfer**
Role of numerical models in applications to thermohydrological flow in fracture rock masses, 6:33210 (LBL—11566)
**FRACTURES**
**Detection**
Detection of fractures from well testing, 6:33930 (LBL—11566)
**Mathematical Models**
Mathematical analysis of factors influencing the development of mining-induced fractures around blind-ended openings with particular reference to Leichhardt Colliery, 6:32858 (CSIRO—7)
**FRANCE**
**Underground Mining**
Emphasis in overseas research on underground coal mining: geomechanical implications (Australian report), 6:32904 (CSIRO—2)
**FREE ELECTRON LASERS**
**Design**
Status of the free-electron laser experiment at Los Alamos, 6:33648 (LA-UR—81-2568)
**FREE RADICALS**
*See RADICALS*
**FRESH WATER ECOSYSTEMS**
*See AQUATIC ECOSYSTEMS*

**F*RESONANCES**
**Weak Hadronic Decay**
Soft-gluon effects in nonleptonic decays of charmed mesons, 6:33975
**FRM DEVICES (THERMONUCLEAR)**
*See FIELD-REVERSED MIRROR REACTORS*
**FTR REACTOR**
*See FFTF REACTOR*
**FUEL ADDITIVES**
**Comparative Evaluations**
Total program approach to freeze conditioning: experiences of Toledo Edison, 6:32937 (EPRI-WS—79-236)
**Evaluation**
Discussion: measuring the effectiveness of FCA, 6:32928 (EPRI-WS—79-236)
**FUEL ASSEMBLIES**
**Heat Transfer**
TCLUST1: a computer program for analysis of intersubassembly heat transfer in an LMFBR, 6:33301 (ANL—81-18)
**FUEL CANS**
**Melting**
Parametric study of multichannel molten cladding motion under unprotected loss-of-flow accident conditions in LMFBR's, 6:33366
**Performance Testing**
High rate transient mechanical properties of unirradiated fast reactor cladding (LMFBR), 6:33358 (HEDL-SA—2288-S)
**Stress Analysis**
Analysis of stresses in GCFR cladding under normal operating conditions, 6:33307
**FUEL CELL CATALYSTS**
*See ELECTROCATALYSTS*
**FUEL CELL POWER PLANTS**
**Environmental Effects**
Environmental R and D needs for advanced power plants, 6:32895
**FUEL COOLING INSTALLATIONS**
*See SPENT FUEL STORAGE*
**FUEL CYCLE**
*See also FUEL MANAGEMENT*
APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste, 6:33318 (BNL—29899)
NASAP and INFCE: the final reports, 6:33321
**Meetings**
Atomic Industrial Forum Inc., fuel cycle conference, 1980, 6:33019
**FUEL ELEMENT FAILURE**
LMFBR fuel-design environment for endurance testing, primarily of oxide fuel elements with local faults, 6:33303 (CONF-8008111—1)
**FUEL FEEDING SYSTEMS**
**Testing**
Coal and limestone feed testing for atmospheric fluidized bed combustion, 6:32948 (ORNL/TM—7724)
**FUEL GAS**
*See also HIGH BTU GAS*
*INTERMEDIATE BTU GAS*
*LOW BTU GAS*
**Combustion**
Controlled combustion of a varying low-btu coal-derived gas, 6:32952
**Sampling**
Real time coarse particle mass measurements in a high temperature and pressure coal gasifier process treatment, 6:32805 (BNL—22952)
Real-time coarse-particle mass measurements in a high-temperature/pressure coal-gasifier process treatment, 6:32806 (BNL—29953)
**FUEL MANAGEMENT**
**Optimization**
REFUEL: a computer program for automated BWR fuel management. Final report, 6:33319 (EPRI-NP—1920)
**FUEL OILS**
*See also HEATING OILS*
*RESIDUAL FUELS*
**Combustion Products**
Particulate emission characteristics of oil-fired urtility boilers, 6:32989 (EPRI-CS—1995)
Soot formation in synthetic fuel droplets. Third quarterly technical progress report, April 1 to June 30, 1981, 6:33743 (DOE/PC/30298—T3)
**FUEL PINS**
**Performance**
LMFBR fuel-design environment for endurance testing, primarily of oxide fuel elements with local faults, 6:33303 (CONF-8008111—1)
**Performance Testing**
Fuel pin behavior under slow overpower transient conditions; HEDL W-2 SLSF experiment results (LMFBR), 6:33357 (HEDL-SA—2284-FP)
**Post-Irradiation Examination**
Technique for preparation of prototypic fast test reactor mixed-oxide fuel pins for ceramography and metallography, 6:33309 (HEDL-SA—2333-FP)
**Quality Assurance**
LMFBR fuel-design environment for endurance testing, primarily of oxide fuel elements with local faults, 6:33303 (CONF-8008111—1)
**Thermal Stresses**
Fuel pin behavior under slow overpower transient conditions; HEDL W-2 SLSF experiment results (LMFBR), 6:33357 (HEDL-SA—2284-FP)
**FUEL REPROCESSING PLANTS**
**Nuclear Materials Management**
Application of ICP-AES to the multi-elemental and multi-isotopic analysis of fuel dissolver solutions. Progress report, 6:33059 (IS-M—337)
**FUEL SLURRIES**
**Rheology**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**FUEL SOLUTIONS**
**Quantitative Chemical Analysis**
On-line monitoring of Plutonium in mixed Uranium-Plutonium solutions, 6:33800 (CONF-800433—)
**FUEL SUBSTITUTION**
**Economic Impact**
Alternative liquid fuels, 6:33494
Technique for planning and managing industrial growth from the air-quality standpoint, 6:33835 (PNL-SA—9419)
**Technology Assessment**
Alternative liquid fuels, 6:33494
**FUEL SUPPLIES**
**Mathematical Models**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**FUEL-CLADDING INTERACTIONS**
Development and performance of metal fuel elements for fast breeder reactors, 6:33316
**FUEL-COOLANT INTERACTIONS**
High temperature chemomechanical interactions between alkali metals and urania-base oxide reactor fuels, 6:33308 (GEFR-SP—236)
**FUELWOOD**
*See WOOD FUELS*
**FULL-SERVE STATIONS**
*See GASOLINE SERVICE STATIONS*
**FUMES**
*See AEROSOLS*
**FUSION REACTIONS**
*(Heavy-ion reactions in which most or all of participating nucleons form single nucleus.)*
**Fission**
Angular momentum effects in fusion-fission and fusion-evaporation reactions, 6:34035
**FUSION REACTORS**
*See THERMONUCLEAR REACTORS*

# G

**GADOLINIUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Emission Spectroscopy**
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**GAGES (STRAIN)**
*See STRAIN GAGES*
**GALLIUM 67**
**Radiopharmaceuticals**
Tricatecholamide analogs of enterobactin as gallium- and indium-binding radiopharmaceuticals, 6:33623
**GALLIUM ARSENIDE SOLAR CELLS**
**Environmental Impacts**
Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**Health Hazards**
Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**GALLIUM ARSENIDES**
**Environmental Impacts**
Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**Health Hazards**
Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**GAMMA DETECTION**
**Li-Drifted Ge Detectors**
Precision energy measurement of $\gamma$ rays from short-lived activities, 6:34009
**GAMMA LOGGING**
**Calibration**
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
**GAMMA RADIATION**
**Carcinogenesis**
Experimental radiation carcinogenesis: what have we learned ($^{60}$Co; fission neutrons; mice), 6:33895
**GAMMA SPECTRA**
**Computer Calculations**
Comparisons of peak-search and photopeak-integration methods in the computer analysis of gamma-ray spectra, 6:33772 (CONF-800433—)
**GAMMA SPECTROSCOPY**
**Calibration**
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
**GAS CENTRIFUGES**
**Counterflow Systems**
Numerical simulation of the countercurrent flow in a gas centrifuge, 6:33016 (LA-UR—81-1821)
**GAS COMPRESSORS**
**Feasibility Studies**
Hydride chemical compressor. Phase I, final report, 6:33631 (BNL—51369)
**Hydridation**
Hydride chemical compressor. Phase I, final report, 6:33631 (BNL—51369)
**GAS COOLED FAST BREEDER REACTORS**
*See GCFR TYPE REACTORS*
**GAS DISCHARGE TUBES**
**Design**
Three-electrode low pressure discharge apparatus and method for uniform ionization of gaseous media (Patent; $CO_2$ laser oscillator and pulse smoother), 6:33652
**GAS FLOW**
**Measuring Instruments**
Dynamic shear-wave velocity measurements using interferometric techniques, 6:33964 (SAND—81-1135C)
**GAS LASERS**
*See also CARBON DIOXIDE LASERS*
**Circulating Systems**
Pressure wave charged repetitively pulsed gas laser (Patent), 6:33651
**GAS STATIONS**
*See GASOLINE SERVICE STATIONS*
**GAS TURBINE ENGINES**
**Aerodynamics**
Cold-air performance of compressor-drive turbine of Department of Energy upgraded automobile gas turbine engine. I. Volute-manifold and stator performance, 6:33486 (DOE/NASA/1011—34)
**Exhaust Gases**
Test results of the Chrysler upgraded automotive gas-turbine engine: initial design, 6:33487 (DOE/NASA/51040—22)
**Fuel Consumption**
Test results of the Chrysler upgraded automotive gas-turbine engine: initial design, 6:33487 (DOE/NASA/51040—22)
**Performance Testing**
Cold-air performance of compressor-drive turbine of Department of Energy upgraded automobile gas turbine engine. I. Volute-manifold and stator performance, 6:33486 (DOE/NASA/1011—34)
Test results of the Chrysler upgraded automotive gas-turbine engine: initial design, 6:33487 (DOE/NASA/51040—22)
**Pitting Corrosion**
Investigation of high temperature corrosion of Ni-Cr alloy by the burning hydrocarbons, 6:33662
**GAS TURBINES**
*See also COAL-FIRED GAS TURBINES*
**Air Pollution**
Design and preliminary results of a fuel flexible industrial gas turbine combustor, 6:32950
**Air Pollution Abatement**
Evaluation of concepts for controlling exhaust emissions from minimally processed petroleum and synthetic fuels, 6:32953
**Combustors**
Design and preliminary results of a fuel flexible industrial gas turbine combustor, 6:32950
Low NO/sub x/ combustion systems for burning heavy residual fuels and high-fuel-bound nitrogen fuels, 6:32951
**Cooling**
Advanced cooling full-scale engine demonstration program. Final report, 6:33259 (EPRI-AP—1933)
Water-cooled gas turbine development program. Final report, 6:33257 (EPRI-AP—1889(Vol.1))
Water-cooled gas turbine development program. Final report, 6:33258 (EPRI-AP—1889-Vol.2)
**Corrosion**
Automated on-line determination of PPB levels of sodium and potassium in low-Btu coal gas and fluidized bed combustor exhaust by atomic emission spectrometry, 6:32861 (IS-M—330)
**Corrosion Products**
Neutron-activation analysis of turbine deposits. Interim report, 6:33573 (EPRI-CS—1958)
**Cost Benefit Analysis**
Combustion turbine combined-cycle R and D project priority analysis. Final report, 6:33260 (EPRI-AP—1943)
**Design**
External combustion steam injected gas turbine for cogeneration. Final report, 6:33254 (DOE/ET/11448—T1)
**Erosion**
Controlled combustion of a varying low-btu coal-derived gas, 6:32952
**Materials**
Controlled combustion of a varying low-btu coal-derived gas, 6:32952
**Materials Testing**
Effects of trace impurities in coal-derived liquid fuels on deposition and accelerated high-temperature corrosion of cast superalloys, 6:33509 (DOE/NASA/2593—22)
**Performance Testing**
External combustion steam injected gas turbine for cogeneration. Final report, 6:33254 (DOE/ET/11448—T1)

**Research Programs**
Combustion turbine combined-cycle R and D project priority analysis. Final report, 6:33260 (EPRI-AP—1943)
**Turbine Blades**
Improved particle trajectory calculations through turbomachinery affected by coal ash particles, 6:32943
**GASOLINE**
**Antiknock Ratings**
Motor gasolines, Winter 1980-81, 6:32988 (DOE/BETC/PPS—81/3)
**Availability**
Analysis of gasoline supply for the United States during the 1979 shortage, 6:33398 (BNL—51330)
**Chemical Composition**
Liquid-liquid chromatography fractionation of organic compounds in complex mixtures: application to automobile exhaust, 6:33575 (IS-T—914)
**Chemical Properties**
Motor gasolines, Winter 1980-81, 6:32988 (DOE/BETC/PPS—81/3)
**Prices**
Impact of motor-gasoline price/availability trends on selected minority and disadvantaged populations, 6:32980 (DOE/MI/01006—T1-Pt.1)
Impact of motor gasoline price/availability trends on selected minority and disadvantaged populations, 6:32981 (DOE/MI/01006—T1-Pt.2)
**GASOLINE SERVICE STATIONS**
**Sampling**
Motor gasolines, Winter 1980-81, 6:32988 (DOE/BETC/PPS—81/3)
**GASTEROPODS**
*See MOLLUSCS*
**GCFR TYPE REACTORS**
**Fuel Cans**
Analysis of stresses in GCFR cladding under normal operating conditions, 6:33307
**GE(LI) DETECTORS**
*See LI-DRIFTED GE DETECTORS*
**GENE RECOMBINATION**
**Spontaneous Mutations**
Spontaneous mitotic recombination in mms8-1, an allele of the CDC9 gene of Saccharomyces cerevisiae, 6:33873
**GENERATORS (AEROSOL)**
*See AEROSOL GENERATORS*
**GENERATORS (ELECTRIC)**
*See ELECTRIC GENERATORS*
**GENERATORS (PULSE)**
*See PULSE GENERATORS*
**GENERATORS (STEAM)**
*See STEAM GENERATORS*
**GENOTYPE**
**Frequency Dependence**
Density- and frequency-dependent selection at the Mdh-2 locus in Drosophila pseudoobscura, 6:33863
**GEOBOTANY**
**Activation Analysis**
Biogeochemical prospecting for gold by neutron activation analysis, 6:33793 (CONF-800433—)
**GEOCHEMICAL SURVEYS**
**Bibliographies**
One hundred prime references on hydrogeochemical and stream sediment surveying for uranium as internationally practiced, including 60 annotated references, 6:33013 (LA—6647-MS)
**GEOPRESSURED SYSTEMS**
**By-Products**
High-pressure solvent extraction of methane from geopressured fluids, 6:33223 (UCRL—86515)
**GEOTHERMAL ENERGY**
**National Program Plans**
Geothermal Energy Research, Development and Demonstration Program. First annual report, 6:33204 (ERDA—77-9)
**Technology Assessment**
Technology characterizations: environmental information handbook. Second edition, 6:33840 (DOE/EP—0028)
**GEOTHERMAL FIELDS**
*See also GEYSERS GEOTHERMAL FIELD*
*SALTON SEA GEOTHERMAL FIELD*
*WAIRAKEI GEOTHERMAL FIELD*
**Flow Models**
Proceedings of the workshop on numerical modeling of thermohydrological flow in fractured rock masses, 6:33047 (LBL—11566)
**GEOTHERMAL FLUIDS**
**Chemical Analysis**
Techniques for geothermal liquid sampling and analysis, 6:33220 (PNL—3801)
**Sampling**
Techniques for geothermal liquid sampling and analysis, 6:33220 (PNL—3801)
**GEOTHERMAL HEATING SYSTEMS**
**Cost**
New Mexico State University campus geothermal demonstration project: an engineering construction design and economic evaluation. Final technical report, February 25, 1980-April 24, 1981, 6:33233
**Design**
New Mexico State University campus geothermal demonstration project: an engineering construction design and economic evaluation. Final technical report, February 25, 1980-April 24, 1981, 6:33233
**GEOTHERMAL POWER PLANTS**
**Direct Contact Heat Exchangers**
Semiannual progress report for the Idaho Geothermal Program, October 1, 1980 to March 31, 1981, 6:33225 (EGG—2110)
**Test Facilities**
Design guide for Geothermal Test Facility, 6:33224 (DOE/ET/28443—T15)
**Testing**
Semiannual progress report for the Idaho Geothermal Program, October 1, 1980 to March 31, 1981, 6:33225 (EGG—2110)
**GEOTHERMAL RESOURCES**
**Resource Development**
Geothermal resources development project: Phase I, 6:33205 (DOE/ET/27167—T1)
**GEOTHERMAL WELLS**
**Flow Models**
Geothermal reservoir simulation capabilities at Systems, Science, and Software (MUSHRM code; CHARM code; LIGHTS code), 6:33213 (LBL—11566)
Numerical model CCC, 6:33212 (LBL—11566)
SHAFT79, 6:33211 (LBL—11566)
**Mathematical Models**
Two-phase flow in geothermal energy sources. Final technical report, 6:33227 (DOE/ET/28359—T1)
**Simulation**
SHAFT79, 6:33211 (LBL—11566)
**Testing**
Geothermal well testing, 6:33232
Pleasant Bayou No. 2: a review of rationale, ongoing research and preliminary test results, 6:33214 (CONF-811026—8)
**Two-Phase Flow**
Flow in geothermal wells. Part IV. Transition criteria for two-phase flow patterns, 6:33226 (DOE/ET/27225—9)
Two-phase flow in geothermal energy sources. Final technical report, 6:33227 (DOE/ET/28359—T1)
**GERMANIUM ARSENIDES**
**Crystal Growth**
Devitrification kinetics of cadmium-germanium-arsenide glasses, 6:33558 (DOE/ER/01198—1367)
**GERMANIUM COMPOUNDS**
**Physical Properties**
Processes and techniques, 6:32839 (LBL—12000)
**GERMANY (FEDERAL REPUBLIC)**
*See FEDERAL REPUBLIC OF GERMANY*
**GETTERS**
**Design**
Design of the TFTR Zr/Al surface pumping panels, 6:34161 (CONF-801011—(Vol.3))

**Performance**
Surface pumping system for TFTR impurity and density control, 6:34163 (CONF-801011—(Vol.3))
**Thermodynamic Properties**
Thermal analysis of the TFTR surface pumping system, 6:34162 (CONF-801011—(Vol.3))
**GEYSERS GEOTHERMAL FIELD**
**Resource Assessment**
Comparative assessment of five potential sites for magma: hydrothermal systems - geophysics, 6:33221 (UCRL—52980)
**GIANT CELLS**
*See TUMOR CELLS*
**GIANT RESONANCE**
**Gamow-Teller Rules**
Energy systematics of the giant Gamow-Teller resonance and a charge-exchange dipole spin-flip resonance, 6:34020
**GLASS**
**Antireflection Coatings**
Antireflecting film development. Final report (For resisting damage from laser pulses), 6:33563 (UCRL—15373)
**Electroplating**
Apparatus for electroplating particles of small dimension (Patent), 6:33567
**Impact Shock**
Fracturing of simulated high-level waste glass in canisters, 6:33041 (PNL—3948)
**Inhalation**
Method of determining glass in rat lung after exposure to a glass fiber aerosol, 6:33914
**Opacity**
Development of uv-transparent fluorophosphate glass. Final report, July 10, 1980-January 10, 1981, 6:33564 (UCRL—15375)
**Production**
Development of uv-transparent fluorophosphate glass. Final report, July 10, 1980-January 10, 1981, 6:33564 (UCRL—15375)
**Thermal Stresses**
Fracturing of simulated high-level waste glass in canisters, 6:33041 (PNL—3948)
**Vitrification**
Devitrification kinetics of cadmium-germanium-arsenide glasses, 6:33558 (DOE/ER/01198—1367)
**GLAUBER'S SALT**
*See SODIUM SULFATES*
**GLIOBLASTOMAS**
*See NEOPLASMS*
**GLUCOCORTICOIDS**
**Biological Effects**
Regulation of retinol-binding protein metabolism by glucocorticoid hormones in cultured $H_4II$ $EC_3$ liver cells, 6:33849
**GLUCOPROTEINS**
**Chromatography**
Proteins of human semen. I. Two-dimensional mapping of human seminal fluid, 6:33848
**GLUONS**
**Particle Production**
Progress report, October 1, 1980-June 30, 1981, 6:33966 (DOE/ER/03509—T1)
**GODIVA REACTOR**
**Reactor Kinetics**
ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)
**GOLD**
**Ion Exchange Chromatography**
Chromatographic separation of metal ions on macroreticular anion-exchange resins of a low capacity, 6:33587
**Prospecting**
Biogeochemical prospecting for gold by neutron activation analysis, 6:33793 (CONF-800433—)
**Voltametry**
Precious metal analysis by controlled potential coulometry, 6:33583
**GOLD 197**
**Carbon 12 Reactions**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**GOLD 197 TARGET**
**Lithium 6 Reactions**
Elastic and inelastic scattering of 88 MeV $^6Li$ ions, 6:34013
**Neutron Reactions**
Neutron capture cross section standards for BNL 325, Fourth Edition, 6:34039 (BNL-NCS—51388)
**GOVERNMENT POLICIES**
*See also ENERGY POLICY*
*ENVIRONMENTAL POLICY*
**Decision Making**
Dose/response relationships and policy formulation, 6:34042 (PNL-SA—9317)
**GRAMINEAE**
**Activation Analysis**
Analysis of fluorine contamination from industrial sources, 6:33907 (CONF-800433—)
**GRANITES**
**Creep**
Importance of creep failure of hard rock in the near field of a nuclear-waste repository, 6:33037 (LA-UR—81-2584)
**Sorptive Properties**
Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)
**Thermal Stresses**
Example of rock fracture characterization for modeling purposes, 6:33038 (LBL—11566)
**GRAPHITE**
**Clathrates**
Processes and techniques, 6:32839 (LBL—12000)
**Electronic Structure**
Phonons in graphite intercalation compounds measured by neutron scattering, 6:33557 (DOE/ER/01198—1354)
**Phonons**
Phonons in graphite intercalation compounds measured by neutron scattering, 6:33557 (DOE/ER/01198—1354)
**Thermal Conductivity**
Thermal conductivity measurements of insulators for fusion blankets, 6:33498 (BNL—29779)
**GREAT BRITAIN**
*See UNITED KINGDOM*
**GREAT LAKES REGION**
*See also ILLINOIS*
*INDIANA*
*MICHIGAN*
*MINNESOTA*
*WISCONSIN*
**Biomass**
Wood resources and utilization patterns in the North Central Region and energy needs for the manufacture of wood products, 6:33114 (MASEC/R—81-005)
**GREENHOUSES**
*See also ATTACHED GREENHOUSES*
**Design**
Heating and cooling applications of atriums and attached greenhouses. A state-of-the-art report, 6:33166 (DOE/SF/11511—T1)
**Reviews**
Heating and cooling applications of atriums and attached greenhouses. A state-of-the-art report, 6:33166 (DOE/SF/11511—T1)
**GROUND SUBSIDENCE**
**Calculation Methods**
Subsidence prediction and control. Phase I. The state of knowledge in Poland concerning the influence of mining exploitation on the surface. Final report, 6:32911 (DOE/TIC—11481)
**Control**
Subsidence prediction and control. Phase I. The state of knowledge in Poland concerning the influence of mining exploitation on the surface. Final report, 6:32911 (DOE/TIC—11481)
**Forecasting**
Subsidence prediction and control. Phase I. The state of knowledge in Poland concerning the influence of mining exploitation on the surface. Final report, 6:32911 (DOE/TIC—11481)
**GROUND WATER**
*See also INTERSTITIAL WATER*

**Autoradiography**
Autoradiographic studies of actinide sorption in groundwater systems, 6:33824 (CONF-800433—)
**Flow Models**
Description and applications of the FE3DGW and CFEST three-dimensional finite-element models, 6:33053 (LBL—11566)
Proceedings of the workshop on numerical modeling of thermohydrological flow in fractured rock masses, 6:33047 (LBL—11566)
**Fluid Flow**
Modeling of groundwater flow in fractured rocks for radioactive waste repository studies, 6:33928 (LBL—11566)
**Geochemistry**
Geochemical exploration for uranium in the Red Desert, Wyoming, 6:33001 (GJBX—125(81))
**Monitoring**
LLNL underground coal gasification project. Quarterly progress report, January-March 1981, 6:32842 (UCRL—50026-81-1)
Monitoring the fixed FGD sludge landfill, Conesville, Ohio. Phase II, 6:32869 (EPRI-CS—1984)
**Radioactivity**
Environmental concentration and migration of $^{129}I$, 6:33767 (PNL-SA—9140)
**Radionuclide Migration**
Description and applications of the FE3DGW and CFEST three-dimensional finite-element models, 6:33053 (LBL—11566)
**Water Pollution**
Organic groundwater contaminants from UCG, 6:32853
**Water Quality**
Monitoring the fixed FGD sludge landfill, Conesville, Ohio. Phase II, 6:32869 (EPRI-CS—1984)

**GROUND-WATER RESERVES**
*See AQUIFERS*

**GUAM**
**Aquatic Ecosystems**
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)
**Geology**
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)
**Oceanography**
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)

**GULF COAST**
**Natural Gas Deposits**
Assessment of in-place solution methane in tertiary sandstones: Texas Gulf Coast, 6:32990 (CONF-811026—5)

**GULF STREAM**
**Temperature Distribution**
Geographic distribution of the OTEC resource off the south and east coasts of the Florida Peninsula, 6:33150 (DOE/ER/05518—1)

## H

**HAEMOPHILUS**
**Recombinant DNA**
Transformation of Haemophilus influenzae by recombinant molecules, 6:33858 (BNL—29733)

**HAFNIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)

**HAIR**
**Multi-Element Analysis**
Trace element analysis of human hair by proton induced X-ray excitation PIXE, 6:33884 (CONF-800433—)
**PIXE Analysis**
Trace element analysis of wild rodent tissues using the PIXE method, 6:33775 (CONF-800433—)
**Quantitative Chemical Analysis**
Neutron activation analysis of hair from breast cancer patients, 6:33867 (CONF-800433—)

**HAULAGE EQUIPMENT**
**Comparative Evaluations**
Evaluation of novel underground transport systems. Final report, 6:32907 (DOE/ET/11268—T3)

**HAWAII**
**Aquatic Ecosystems**
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)
**Geology**
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)
**Oceanography**
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)

**HAZARDOUS MATERIALS**
**Public Opinion**
Public perceptions of industrial risks: the context of public attitudes toward radioactive waste, 6:33382 (PNL—3799)

**HD 8077**
*See NICKEL BASE ALLOYS*

**HEALTH HAZARDS**
*See also RADIATION HAZARDS*
**Teratogenesis**
Epidemiological approaches to reproductive hazards of the workplace, 6:33913 (PNL-SA—9435)

**HEALTH PHYSICS**
*See RADIATION PROTECTION*

**HEART DISEASE**
*See CARDIOVASCULAR DISEASES*

**HEAT EXCHANGERS**
*See also DIRECT CONTACT HEAT EXCHANGERS*
*FLUIDIZED BED HEAT EXCHANGERS*
*HEAT PUMPS*
**Cleaning**
Effect of mechanical cleaning on seawater corrosion of candidate OTEC heat exchanger materials. Part 2. Tests with Amertap sponge rubber balls, 6:33149 (ANL/OTEC-BCM—018)
**Materials**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**Materials Testing**
Effect of mechanical cleaning on seawater corrosion of candidate OTEC heat exchanger materials. Part 2. Tests with Amertap sponge rubber balls, 6:33149 (ANL/OTEC-BCM—018)
**Technology Assessment**
US ceramic heat exchanger technology: status and opportunities, 6:33253 (CONF-810946—1)

**HEAT MIRRORS**
**Research Programs**
Energy-efficient windows program, 6:33453 (LBL—11985)

**HEAT PUMPS**
*See also SOLAR-ASSISTED HEAT PUMPS*
**Capacity**
Variable capacity compressor controller, 6:33448 (DOE/CS/35224—T1)
**Compressors**
Variable capacity compressor controller, 6:33448 (DOE/CS/35224—T1)

**Energy Efficiency**
Variable capacity compressor controller, 6:33448 (DOE/CS/35224—T1)
**Performance**
Cycle and performance analysis of absorption heat pumps for waste heat utilization, 6:33471 (ORNL/TM—7852)
**Waste Heat Utilization**
Cycle and performance analysis of absorption heat pumps for waste heat utilization, 6:33471 (ORNL/TM—7852)

**HEAT RECOVERY EQUIPMENT**
**Cost**
Utilization of waste heat from major transformer substations. Volume 2. Site-specific study. Final report, 6:33478 (EPRI-EM—1968(Vol.2))
**Demonstration Programs**
Utilization of waste heat from major transformer substations. Volume 1. Generic study. Final report, 6:33477 (EPRI-EM—1968(Vol.1))
**Design**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 9. Design approaches: CAES, Appendix C. Major mechanical equipment. Final report, 6:33369 (EPRI-EM—1589(Vol.9)(App.C))
Utilization of waste heat from major transformer substations. Volume 1. Generic study. Final report, 6:33477 (EPRI-EM—1968(Vol.1))
**Technology Assessment**
US ceramic heat exchanger technology: status and opportunities, 6:33253 (CONF-810946—1)

**HEAT RESISTING ALLOYS**
**Corrosion**
Effects of trace impurities in coal-derived liquid fuels on deposition and accelerated high-temperature corrosion of cast superalloys (IN-100; IN-792; Mar M-509; IN-738), 6:33509 (DOE/NASA/2593—22)

**HEAT STORAGE**
*See also LATENT HEAT STORAGE*
*SENSIBLE HEAT STORAGE*
**Bibliographies**
Bibliography of the seasonal thermal energy storage library, 6:33374 (PNL—3645)
**Research Programs**
SERI Solar-Energy-Storage Program, 6:33202 (SERI/TP—620-1344)
United States Department of Energy thermal energy storage program, 6:33373 (DOE/RL/01830—T6)
**Technology Assessment**
United States Department of Energy thermal energy storage program, 6:33373 (DOE/RL/01830—T6)

**HEAT TRANSFER**
Manual for use with the computer code SUPERENERGY: data reduction version (LMFBR), 6:33304 (DOE/ET/37240—74TR)
**Mathematical Models**
Thermal-hydraulic differential sensitivity theory, 6:33312 (ORNL/CSD/TM—126)
**Research Programs**
SERI Solar-Energy-Storage Program, 6:33202 (SERI/TP—620-1344)

**HEAT TRANSMISSION**
*See HEAT TRANSFER*

**HEATERS**
*See also WATER HEATERS*
**Failure Mode Analysis**
Failure modes and effects analysis of a coal-slurry preheater, 6:32841 (ORNL/TM—7664)

**HEATING OILS**
**Chemical Properties**
Heating oils, 1981, 6:32985 (DOE/BETC/PPS—81/4)
**Combustion Properties**
Heating oils, 1981, 6:32985 (DOE/BETC/PPS—81/4)
**Physical Properties**
Heating oils, 1981, 6:32985 (DOE/BETC/PPS—81/4)

**HEAVY ION ACCELERATORS**
**Design**
Radio-frequency quadrupole linac in a heavy-ion fusion driver system, 6:34113 (CONF-801011—(Vol.2))
**Reviews**
Heavy ion induction linacs for ICF, 6:34110 (CONF-801011—(Vol.2))

**HEAVY ION REACTIONS**
*See also ARGON 40 REACTIONS*
*CARBON 12 REACTIONS*
*CARBON 14 REACTIONS*
*DEEP INELASTIC HEAVY ION REACTIONS*
*KRYPTON 86 REACTIONS*
*LITHIUM 6 REACTIONS*
*NEON 20 REACTIONS*
*NITROGEN 15 REACTIONS*
*OXYGEN 16 REACTIONS*
*SILICON 28 REACTIONS*
**Backscattering**
New surface phenomena in heavy-ion-induced reactions, 6:33996
**Elastic Scattering**
New surface phenomena in heavy-ion-induced reactions, 6:33996
**Fission**
Angular momentum effects in fusion-fission and fusion-evaporation reactions, 6:34035
**Inclusive Interactions**
What can we learn from inclusive spectra, 6:33969 (LBL—12950)
**Inelastic Scattering**
New surface phenomena in heavy-ion-induced reactions, 6:33996
**Multiple Production**
Finite particle number effects in high-energy nuclear collisions. Implications on pion spectra, 6:33971
**Nuclear Reaction Kinetics**
Description and use of the Monte Carlo code LILITA, 6:34019 (ORNL/TM—7295)
**Research Programs**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**Spin Orientation**
Multiple Coulomb polarization potential for heavy ion scattering, 6:34025

**HELICAL INSTABILITY**
Helical equilibrium, 6:34067 (PPPL—1829)

**HELIOSTATS**
**Design**
Second generation heliostat program, 6:33196 (SAND—81-8177-Exec.Summ.)
Second generation heliostat. Final report, 6:33197 (SAND—81-8177-Vol.1)
**Manufacturing**
Second generation heliostat program, 6:33196 (SAND—81-8177-Exec.Summ.)
Second generation heliostat. Final report, 6:33197 (SAND—81-8177-Vol.1)
Second generation heliostat. Volume II. Definition of a heliostat manufacturing facility. Final report, 6:33198 (SAND—81-8177-Vol.2)
**Operation**
Heliostat operation at the Central Receiver Test Facility (1978-1980), 6:33146 (SAND—81-0275-Rev.)
**Radiant Flux Density**
Numerical approach to the flux density integral for reflected sunlight, 6:33200
**Testing**
Second generation heliostat. Final report, 6:33197 (SAND—81-8177-Vol.1)

**HELIUM 3**
**Collisions**
Direct experimental determination of the particle reflection coefficients of low-energy (100 to 1500 eV) $^{3}$He and $^{4}$He atoms from the (110) plane of tungsten, 6:33956 (DOE/ER/03158—93)

**HELIUM 3 REACTIONS**
**Total Cross Sections**
Energy dependence of nucleus-nucleus total cross sections, 6:34006

**HELIUM 3 TARGET**
**Pion Plus Reactions**
Two-nucleon pion absorption in $^{3}$sup(,)$^{4}$He, 6:33999

**HELIUM 4**
**Collisions**
Direct experimental determination of the particle reflection coefficients of low-energy (100 to 1500 eV) $^{3}$He and $^{4}$He atoms from the (110) plane of tungsten, 6:33956 (DOE/ER/03158—93)
**HELIUM 4 TARGET**
**Pion Plus Reactions**
Two-nucleon pion absorption in $^{3}$sup(,)$^{4}$He, 6:33999
**HELIUM IONS**
**Electron Detachment**
Photodetachment cross sections for $He^{-}$ ($^{4}P^{o}$), 6:33961
**HELIUM METHOD**
*See ISOTOPE DATING*
**HEMOPHILUS**
*See HAEMOPHILUS*
**HEPTANE**
**Evaporation**
Multicomponent fuel droplet vaporization at large Reynolds numbers, 6:33627
**HEXADECANE**
**Liquid Column Chromatography**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**NMR Spectra**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**HEXANE**
**Evaporation**
Multicomponent fuel droplet vaporization at large Reynolds numbers, 6:33627
**Liquid Column Chromatography**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**NMR Spectra**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**HGI2 SEMICONDUCTOR DETECTORS**
**Resolution**
Radiation detection system using semiconductor detector with differential carrier trapping and mobility (Patent), 6:33692
**HIGH BTU GAS**
**Biosynthesis**
Peat biogasification development program, 6:33081 (DOE/ET/14696—T6)
**Cocombustion**
Feasibility and economic study of medium-Btu coal gas blended with high-Btu by-product gas as an industrial energy source at Billings, Montana. Final report, 6:33082 (DOE/FE/20219—2)
**Production**
Single-stage fluidized-bed gasification, 6:32845
**HIGH ENERGY PHYSICS**
**Research Programs**
Very-high-energy nuclear physics. Progress report, July 1, 1980-June 30, 1981, 6:33968 (DOE/ER/04660—1)
**HIGH EXPLOSIVES**
*See CHEMICAL EXPLOSIVES*
**HIGH FLUX NEUTRON SOURCE FACILITY**
*See NEUTRON SOURCE FACILITIES*
**HIGH SPIN STATES**
**Yrast States**
Yrast spectroscopy: status of yrast isomers, oblate shapes and feeding of yrast states, 6:34015
**HIGH-FREQUENCY HEATING**
**Energy Balance**
Simple-power-balance model for microwave heating in EBT, 6:34064 (ORNL/TM—7001)
**Materials Testing**
Materials application in neutral beam injectors and RF heating systems, 6:34137 (CONF-801011—(Vol.2))
**HIGH-TEMPERATURE GAS-COOLED REACTOR**
*See HTGR TYPE REACTORS*
**HIGH-VOLTAGE PULSE GENERATORS**
**Switching Circuits**
High voltage, magnetically switched pulsed power systems, 6:33658 (SAND—81-0754C)
**Transformers**
High-voltage air-core pulse transformers, 6:33657 (SAND—80-0451)
**HODOSCOPES**
**Design**
Fine-grained hodoscopes based on scintillating optical fibers, 6:33686 (BNL—29923)
**Fiber Optics**
Fine-grained hodoscopes based on scintillating optical fibers, 6:33686 (BNL—29923)
**HOLMIUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**HOLMIUM 161**
**Energy Levels**
Nuclear structure of $^{161}$sup(,)$^{163}$Ho studied with the (t vector,$\alpha$) reaction, 6:34022
**HOLMIUM 163**
**Energy Levels**
Nuclear structure of $^{161}$sup(,)$^{163}$Ho studied with the (t vector,$\alpha$) reaction, 6:34022
**HOLMIUM 165**
**Carbon 12 Reactions**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**Proton Reactions**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**HOPPERS**
**Design**
Feeding dry fly ash without flooding and flushing, 6:32927 (EPRI-WS—79-236)
In-plant coal handling, 6:32934 (EPRI-WS—79-236)
**HOT WATER HEATERS**
*See WATER HEATERS*
**HOT-DRY-ROCK SYSTEMS**
**Caliper Logging**
High-temperature logging for basic development of HDR reservoirs, 6:33218 (LA-UR—81-1765)
**Heat Extraction**
Hot dry rock geothermal energy development program. Annual report, fiscal year 1980, 6:33228 (LA—8855-HDR)
**Hydraulic Fracturing**
Status report--hot dry rock geothermal energy, 6:33231
**Research Programs**
Hot dry rock geothermal energy development program. Annual report, fiscal year 1980, 6:33228 (LA—8855-HDR)
Status report--hot dry rock geothermal energy, 6:33231
**Site Selection**
Hot dry rock geothermal prospects, 1981, 6:33219 (LA-UR—81-1807)
**Stress Relaxation**
Relaxation of geothermal-reservoir stresses induced by heat production, 6:33229 (LA—8954-MS)
**Temperature Logging**
High-temperature logging for basic development of HDR reservoirs, 6:33218 (LA-UR—81-1765)
**Well Drilling**
Hot dry rock geothermal energy development program. Annual report, fiscal year 1980, 6:33228 (LA—8855-HDR)
**HOUSEHOLDS**
**Energy Consumption**
National Interim Energy-Consumption Survey: exploring the variability in energy consumption, 6:33449 (DOE/EIA—0272)
**HOUSES**
**Air Infiltration**
Midway house-tightening project: a study of indoor air quality, 6:33458 (LBL—12777)

**Design**
MASEC Solar 80 home designs, 6:33178 (MASEC-PA—80-007)
**Indoor Air Pollution**
Midway house-tightening project: a study of indoor air quality, 6:33458 (LBL—12777)
**Passive Solar Heating Systems**
MASEC Solar 80 home designs, 6:33178 (MASEC-PA—80-007)
**Weatherization**
Midway house-tightening project: a study of indoor air quality, 6:33458 (LBL—12777)

**HTGR TYPE REACTORS**
*See also VRAIN REACTOR*
**Economics**
Feasibility of the high temperature gas-cooled reactor for cogeneration of process steam and electric power for a large oil refinery, 6:33322 (DOE/ET/34222—1)
**Feasibility Studies**
Feasibility of the high temperature gas-cooled reactor for cogeneration of process steam and electric power for a large oil refinery, 6:33322 (DOE/ET/34222—1)
**Petroleum Refineries**
Feasibility of the high temperature gas-cooled reactor for cogeneration of process steam and electric power for a large oil refinery, 6:33322 (DOE/ET/34222—1)

**HUMAN CELLS**
*See ANIMAL CELLS*

**HUMAN POPULATIONS**
**Dose Commitments**
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)
**Genetics**
Progress report on research on human genetics in Iceland, 6:33859 (DOE/EV/03214—T3)
**Radiation Doses**
Population dose estimation from a hypothetical release of 2.4 x $10^6$ curies of noble gases and 1 x $10^4$ curies of $^{131}I$ at the Three Mile Island Nuclear Station, Unit 2, 6:33361 (ORNL/TM—7980)
**Radiation Hazards**
Engineering assessment of inactive uranium mill tailings, Naturita Site, Naturita, Colorado, 6:33024 (DOE/UMT—012)
Engineering assessment of inactive uranium mill tailings, Shiprock site, Shiprock, New Mexico, 6:33026 (DOE/UMT—0104)
Summary of the engineering assessment of inactive uranium mill tailings, Naturita site, Naturita, Colorado, 6:33025 (DOE/UMT—012S)
Summary of the engineering assessment of inactive uranium mill tailings, Shiprock Site, Shiprock, New Mexico, 6:33027 (DOE/UMT—0104S)

**HVAC SYSTEMS**
**Power Transmission Lines**
Formulas for predicting audible noise from overhead high voltage ac and dc lines, 6:33287

**HVDC SYSTEMS**
**Electrical Insulators**
Contamination flashover of HVDC insulators. Final report, 6:33282 (EPRI-EL—2016)
**Load Analysis**
Measurement and modeling of Pacific ac Intertie response to random load switching, 6:33288
**Power Transmission Lines**
Formulas for predicting audible noise from overhead high voltage ac and dc lines, 6:33287

**HYBRID REACTORS**
**Breeding Blankets**
Characteristics of a spectral-shift blanket for hybrid reactor application, 6:34122 (CONF-801011—(Vol.2))
**Breeding Ratio**
Cost of generating tritium internal and external to a tokamak hybrid reactor, 6:34099 (CONF-801011—(Vol.1))
**Design**
Comparison of wetted-wall and magnetically protected-wall inertial fusion hybrid concepts, 6:34123 (CONF-801011—(Vol.2))
Production of substitute natural gas by a fusion hybrid reactor coupled to a catalyzed coal gasification plant, 6:34125 (CONF-801011—(Vol.2))
**Environmental Impacts**
Fusion-fission hybrids: environmental aspects and their role in hybrid rationale, 6:34188
Fusion-fission hybrids and the environment: resource requirements, 6:34103 (CONF-801011—(Vol.2))
**Feasibility Studies**
Fission suppressed tandem mirror hybrid reactor options, 6:34117 (CONF-801011—(Vol.2))
Fusion hybrid parametric studies to assess potential utility applications, 6:34114 (CONF-801011—(Vol.2))
Utility market penetration assessment of fusion-fission hybrids, 6:34118 (CONF-801011—(Vol.2))
**Fuel Cycle**
Fuel cycle issues for suppressed fission-fusion breeders, 6:34124 (CONF-801011—(Vol.2))
Fusion-fission combinations with DT and DD fuels, 6:34121 (CONF-801011—(Vol.2))
Study of DD versus DT fusion fuel cycles for different fusion-fission hybrid energy systems, 6:34119 (CONF-801011—(Vol.2))
**Parametric Analysis**
Parametric systems analysis for ICF hybrid reactors, 6:34115 (CONF-801011—(Vol.2))
Parametric systems analysis for tokamak hybrid reactors, 6:34116 (CONF-801011—(Vol.2))
**Radioactive Waste Disposal**
Potential for lessened waste hazards from the thorium cycle by means of fusion symbiosis, 6:33066 (CONF-801011—(Vol.2))
**Technology Assessment**
Fusion-fission hybrid reactors, 6:33320

**HYDRAULIC FRACTURING**
**Evaluation**
Field assessment of hydraulic fracturing as a stress measurement technique for near-surface applications: Stage 1, 6:32916

**HYDRAULIC MINING**
**Mining Equipment**
Development of a longwall water jet mining machine. Final technical report, 6:32909 (DOE/ET/12542—T1)

**HYDRAULICS**
Manual for use with the computer code SUPERENERGY: data reduction version (LMFBR), 6:33304 (DOE/ET/37240—74TR)
**Mathematical Models**
Thermal-hydraulic differential sensitivity theory, 6:33312 (ORNL/CSD/TM—126)

**HYDROCARBON LOGGING**
*See WELL LOGGING*

**HYDROCARBONS**
*See also NAPHTHALENE*
*POLYCYCLIC AROMATIC HYDROCARBONS*
*POLYENES*
*TETRALIN*
*XYLENES*
**Chemisorption**
Processes and techniques, 6:32839 (LBL—12000)
**Combustion**
Investigation of high temperature corrosion of Ni-Cr alloy by the burning hydrocarbons, 6:33662
**Monitoring**
MAP3S/RAINE emissions inventory. Progress report, December 1980, 6:33725 (BNL—51378)
**Phase Studies**
Processes and techniques, 6:32839 (LBL—12000)

**HYDROCYANIC ACID**
**Oxidation**
Fundamentals of nitric oxide formation in fossil-fuel combustion. Progress report, 29 September-28 December 1980, 6:32944 (DOE/ET/10593—T2)

**HYDROGEN**
**Bibliographies**
Hydrogen energy: a bibliography with abstracts. Quarterly update, January-March 1981 (219 references), 6:33075 (TAC/H—81-001)
**Diffusion**
Tritium autoradiography, 6:33654 (DP-MS—81-12)
**Distribution**
Tritium autoradiography, 6:33654 (DP-MS—81-12)
**Gas Compressors**
Hydride chemical compressor. Phase I, final report, 6:33631 (BNL—51369)
**Recovery**
Solubility of hydrogen in coal liquids, 6:32830 (DOE/OR/03054—3)
**Solubility**
Solubility of hydrogen in coal liquids, 6:32830 (DOE/OR/03054—3)
**HYDROGEN 1 TARGET**
**Deuteron Reactions**
Description of polarization analyzing powers for three-body breakup reactions, 6:33998
**Proton Reactions**
Inclusive proton spectra and total reaction cross sections for proton-nucleus scattering at 800 MeV, 6:33997 (LA—8937-T)
**HYDROGEN 2**
*See DEUTERIUM*
**HYDROGEN 3**
*See TRITIUM*
**HYDROGEN COMPOUNDS**
**Neutron Diffraction**
Neutron scattering studies of quasi one- and two-dimensional hydrogen-bonded ferroelectrics, 6:34037 (BNL—30004)
**HYDROGEN CYANIDES**
*See HYDROCYANIC ACID*
**HYDROGEN DONOR REACTIONS**
*See HYDROGEN TRANSFER*
**HYDROGEN LOGS**
*See NEUTRON-GAMMA LOGGING*
**HYDROGEN METERS**
**Calibration**
User's guide to the hydrogen monitor, 6:33577 (LA—8957-MS)
**Manuals**
User's guide to the hydrogen monitor, 6:33577 (LA—8957-MS)
**HYDROGEN PRODUCTION**
*See also THERMOCHEMICAL PROCESSES*
**Electrolysis**
Electrochemical gasification of coal--simultaneous production of hydrogen and carbon dioxide by a single reaction involving coal, water, and electrons, 6:32850
Parametric study of the cadmium thermoelectrochemical hydrogen cycle, 6:33078 (CONF-810812—38)
Use of alkali metal-acid phosphates for elevated temperature water electrolysis, 6:33077 (UCRL—86623)
**Evaluation**
Electrochemical gasification of coal--simultaneous production of hydrogen and carbon dioxide by a single reaction involving coal, water, and electrons, 6:32850
**Thermochemical Processes**
Ammonium iodide-potassium iodide mixed crystals in equilibrium with aqueous and aqueous-2-propanol solutions, 6:33596
Design considerations for high-temperature synthetic fuel production fusion reactors, 6:33064 (CONF-801011—(Vol.2))
Hydrogen production based on magnetic fusion, 6:33065 (UCRL—86600)
Solar furnace study of zinc sulfate decomposition, 6:33076 (UCRL—86622)
**HYDROGEN TRANSFER**
**Chemical Reaction Kinetics**
Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Annual progress report, February 1980-February 1981, 6:32834 (DOE/PC/30080—4)
**HYDROGENATION**
**Catalysts**
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1980, 6:32814 (DOE/ET/14700—2)
**HYDROXIDES**
**Volatility**
Predictive calculations of volatilities of metals and oxides in steam-containing environments, 6:33055 (UCRL—85553)
**HYDROXY COMPOUNDS**
*(For organic compounds only and excluding SACCHARIDES, GLYCOSIDES and HYDROXY ACIDS.)*
*See also PHENOLS*
*STEROLS*
**Chemical Reactions**
Exploratory study of coal-conversion chemistry. Quarterly report No. 9, March 20, 1980-June 19, 1980 (Hydroxydiphenylmethane, diphenylether, diphenymethane), 6:32816 (DOE/ET/14855—9)
Exploratory study of coal-conversion chemistry. Quarterly report, December 20, 1979-March 19, 1980 (Ortho and para-hydroxydiphenylmethanes), 6:32815 (DOE/ET/14855—6)
**HYDROXYBENZENE**
*See PHENOL*
**HYDROXYLAMINE**
**Chemical Reaction Kinetics**
Kinetics of the reaction between $NH_2OH$ and $SO_2$ in aqueous solutions, 6:33751 (LBL—11986)
**HYDROXYNAPHTHALENES**
*See NAPHTHOLS*
**HYLIFE CONVERTER**
**Breeding Blankets**
Suppressed fission blanket concepts for inertial confinement fusion, 6:34120 (CONF-801011—(Vol.2))
**HYPERFRAGMENTS**
*See HYPERNUCLEI*
**HYPERNUCLEI**
**Energy Levels**
Experimental study of the sigma-nucleon system through the reaction d(K,$\pi$)SIGMA N. Progress report, January 1, 1981-December 31, 1981, 6:33967 (DOE/ER/04195—5)
**HYPERONS**
*See also XI PARTICLES*
**Particle Production**
Progress report, October 1, 1980-June 30, 1981, 6:33966 (DOE/ER/03509—T1)
**HYPERTHERMIA**
**Radiosensitivity Effects**
Abstracts of twenty-ninth annual meeting of the Radiation Research Society, Minneapolis, Minnesota, 31 May-4 June 1981 (Lead abstract), 6:33897
**HYPOCHLOROUS ACID**
**Chemical Reactions**
Rate of reaction of superoxide radical with chloride-containing species, 6:33598
**Toxicity**
Comparative toxicity of hypochlorous acid and hypochlorite ions to mosquitofish, 6:33915
**HYPOPHYSIS**
*See PITUITARY GLAND*

## I

**I-BEAM TYPE REACTORS**
**Breeding Blankets**
Neutronic and thermal performance of a blanket design for an inertially confined fusion commercial power reactor, 6:34141 (CONF-801011—(Vol.3))
**Heavy Ion Accelerators**
Heavy ion induction linacs for ICF, 6:34110 (CONF-801011—(Vol.2))
**ICELAND**
**Demography**
Progress report on research on human genetics in Iceland, 6:33859 (DOE/EV/03214—T3)

**IEUS**
**Combined-Cycle Power Plants**
Assessment of coal-using, combined-cycle, heat-engine options for residential/commercial total and integrated energy systems, 6:33252 (ANL/FE—81-55)
**Feasibility Studies**
Assessment of coal-using, combined-cycle, heat-engine options for residential/commercial total and integrated energy systems, 6:33252 (ANL/FE—81-55)
**ILLINOIS**
**Geothermal Resources**
Multi-task support to the Division of Geothermal Energy's hydrothermal resources program. Final report, 6:33206 (DOE/EV/10072—5)
**Magnetic Surveys**
Airborne gamma-ray spectrometer and magnetometer survey: Peoria, Decater, Belleville Quadrangles, (IL). Final report, 6:33005 (GJBX—241-81-Vol.1)
**Radiometric Surveys**
Airborne gamma-ray spectrometer and magnetometer survey: Peoria, Decater, Belleville Quadrangles, (IL). Final report, 6:33005 (GJBX—241-81-Vol.1)
**IMAGES**
**Storage**
Effects of ion implantation on the photoferroelectric properties of lead lanthanum zirconate titanate ceramics, 6:33561 (SAND—81-1834C)
**IMMUNITY**
**Genetic Variability**
Genetic constraints in the induction of the immune response to Ehrlich ascites tumor in mice (X ray), 6:33902
**IMMUNOSUPPRESSION**
**Radioinduction**
Genetic constraints in the induction of the immune response to Ehrlich ascites tumor in mice (X ray), 6:33902
**IMPERMEABLE DRY ROCK**
*See HOT-DRY-ROCK SYSTEMS*
**IMPURITIES**
**Measuring Methods**
Determination of mineral matter in coal by target transformation factor analysis, 6:33783 (CONF-800433—)
**INCINERATORS**
**Air Pollution Control**
Anti-pollution solid waste burning incinerator (Patent), 6:33481
**Fuel Consumption**
Demonstration of waste-sludge incinerator fuel reduction: pilot project report, 6:33476 (DOE/CS/20321—1)
**INCONEL 600**
**Stress Corrosion**
Method for controlled stress corrosion cracking in nonsensitized inconel 600 tubing, 6:33329
**INCONEL 718**
**Physical Radiation Effects**
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
**Swelling**
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
**INCONEL ALLOYS**
*See also INCONEL 600*
*INCONEL 718*
*INCONEL X750*
**Chemical Radiation Effects**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Corrosion**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**INCONEL X750**
**Physical Radiation Effects**
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
**Swelling**
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
**IN-CORE FUEL MANAGEMENT**
*See FUEL MANAGEMENT*
**INDIANA**
**Geothermal Resources**
Multi-task support to the Division of Geothermal Energy's hydrothermal resources program. Final report, 6:33206 (DOE/EV/10072—5)
**INDIUM 111**
**Radiopharmaceuticals**
Tricatecholamide analogs of enterobactin as gallium- and indium-binding radiopharmaceuticals, 6:33623
**INDOOR AIR POLLUTION**
**Field Tests**
Building ventilation and indoor air quality, 6:33452 (LBL—11985)
**Health Hazards**
Building ventilation and indoor air quality, 6:33452 (LBL—11985)
Health effects: indoor air quality research strategy plan, 6:33885 (CONF-801259—)
Indoor air quality (Health hazards due to energy conservation measures), 6:33758 (LBL—12887)
**Monitoring**
Monitoring indoor air quality, 6:33739 (CONF-801259—)
**Quantitative Chemical Analysis**
Report of the instrumentation subgroup of indoor air quality, 6:33740 (CONF-801259—)
**Research Programs**
Building ventilation and indoor air quality, 6:33452 (LBL—11985)
Workshop on indoor air quality research needs, 6:33738 (CONF-801259—)
**Sampling**
Report of the instrumentation subgroup of indoor air quality, 6:33740 (CONF-801259—)
**INDUCED POLARIZATION LOGGING**
*See NUCLEAR MAGNETIC LOGGING*
**INDUSTRIAL LAUNDRIES**
*See LAUNDRIES*
**INDUSTRIAL PLANTS**
*See also COAL GASIFICATION PLANTS*
*COAL LIQUEFACTION PLANTS*
*COAL PREPARATION PLANTS*
*OIL SHALE PROCESSING PLANTS*
*PETROCHEMICAL PLANTS*
*WASTE PROCESSING PLANTS*
**Boilers**
Coal and ash handling in a typical industrial boiler plant, 6:33647
**Energy Consumption**
Process models for industry, 6:33464 (BNL—29880)
**Fluidized-Bed Combustors**
Fluidized-bed-fired industrial boilers, 6:33663
**Load Management**
Selective load control for industrial customers, 6:33264 (ORNL/Sub—7399/1)
**Occupational Safety**
Guidance for implementing an environmental, safety and health assurance program. Volume 14. Model guidelines for utilizing quality assurance support in environmental, safety and health assurance programs (Guidance for quality assurance programs), 6:33921 (SAND—81-0645)
**INDUSTRIAL SECTOR**
*See INDUSTRY*
**INDUSTRY**
*See also CHEMICAL INDUSTRY*
*COAL INDUSTRY*
*ELECTRIC POWER INDUSTRY*
*FOOD INDUSTRY*
*NUCLEAR INDUSTRY*
*OIL SAND INDUSTRY*
*OIL SHALE INDUSTRY*
*PAPER INDUSTRY*
*PETROLEUM INDUSTRY*
*SOLAR INDUSTRY*
**Cogeneration**
Institutional obstacles to industrial cogeneration, 6:33393
**Energy Conservation**
Information for decisionmakers. Energy conservation in industry and Department of Energy facilities, 6:33444 (CONF-7803136—)

**Energy Models**
Process models for industry, 6:33464 (BNL—29880)
**Solar Process Heat**
Solar thermal energy: abstracts of a special seminar for industry, 6:33185 (SAND—81-0373)
**INFORMATION**
**Security**
Identifier protection in a distributed operating system, 6:34203 (UCRL—86143)
**INFORMATION SYSTEMS**
**Data Base Management**
Managing large-scale models: DBS, 6:33384 (DOE/EP—0006)
**INFORMATION THEORY**
**Forecasting**
Fact retrieval for the 1980s, 6:34202 (UCRL—85749)
**INFRARED SURVEYS**
**Equipment**
Laboratory and field portable system for calibrating airborne multispectral scanners, 6:33697 (EGG—1183-1777)
**INHALATION EXPOSURE CHAMBERS**
*See EXPOSURE CHAMBERS*
**INHIBITORS (ENZYME)**
*See ENZYME INHIBITORS*
**INJECTION (BEAMS)**
*See BEAM INJECTION*
**INLAND WATERWAYS**
**Ice**
Effects of ice on coal movement via the inland waterways. Special report 81-13, 6:33404 (DOE/ET/14356—T1)
**INPUT-OUTPUT ANALYSIS**
*See ENERGY ANALYSIS*
**IN-SITU COMBUSTION**
**Demonstration Programs**
Bodcau in situ combustion project. Fourth annual report, September 1, 1979-February 28, 1981, 6:32969 (DOE/ET/12057—8)
**IN-SITU GASIFICATION**
Organic groundwater contaminants from UCG, 6:32853
**Bench-Scale Experiments**
LLNL underground coal gasification project. Quarterly progress report, January-March 1981, 6:32842 (UCRL—50026-81-1)
**Mathematical Models**
LLNL underground coal gasification project. Quarterly progress report, January-March 1981, 6:32842 (UCRL—50026-81-1)
**On-Line Measurement Systems**
Continuous analyzer system for in-situ coal gasification project, 6:32854
**Planning**
LLNL underground coal gasification project. Quarterly progress report, January-March 1981, 6:32842 (UCRL—50026-81-1)
**IN-SITU RETORTING**
**Spent Shales**
Investigations of Occidental Oil Shale, Inc., retort 3E spent shales, 6:32995 (LA—8792-MS)
**INSTITUTIONAL SECTOR**
**Photovoltaic Power Supplies**
Photovoltaics and the national park service: an institutional analysis, 6:33102 (MIT-EL—80-007)
**INSULATION (THERMAL)**
*See THERMAL INSULATION*
**INTEGRATED ENERGY UTILITY SYSTEMS**
*See IEUS*
**INTEGRATED UTILITY SYSTEMS**
*See TOTAL ENERGY SYSTEMS*
**INTERCONNECTED POWER SYSTEMS**
**Public Utility Regulatory Policies Act**
PURPA and PV systems, 6:33434
**INTERFEROMETERS**
**Performance**
Dynamic shear-wave velocity measurements using interferometric techniques, 6:33964 (SAND—81-1135C)
Optical analysis and alignment applications using the infrared Smartt interferometer, 6:34176 (LA-UR—81-2468)
**INTERMEDIATE BTU GAS**
**Cocombustion**
Feasibility and economic study of medium-Btu coal gas blended with high-Btu by-product gas as an industrial energy source at Billings, Montana. Final report, 6:33082 (DOE/FE/20219—2)
**Feasibility Studies**
Low/medium-Btu coal-gasification assessment of central plant for the city of Philadelphia, Pennsylvania, 6:32836 (DOE/RA/20222—2)
**Market**
Low/medium-Btu coal-gasification assessment of central plant for the city of Philadelphia, Pennsylvania, 6:32836 (DOE/RA/20222—2)
**INTERMEDIATE TECHNOLOGY**
*See APPROPRIATE TECHNOLOGY*
**INTERMEDIATE VECTOR BOSONS**
**Rest Mass**
Bounds on the masses of neutral generation-changing gauge bosons, 6:33979
**INTERMEDIATE-LEVEL RADIOACTIVE WASTES**
**Radiation Monitoring**
Environmental radiological survey of the intermediate-level waste system pipeline, 6:33803 (ORNL/TM—7858)
**INTERNATIONAL ENERGY AGENCY**
**Energy Shortages**
Preparing for an oil crisis: elements and obstacles in crisis management, 6:33403
**INTERSTITIAL WATER**
**Salinity**
Salinity of deep formation waters, Texas Gulf Coast - preliminary results, 6:32991 (CONF-811026—6)
**INTOR TOKAMAK**
**First Wall**
Critical materials problems in INTOR, 6:34129 (CONF-801011—(Vol.2))
**Planning**
INTOR workshop, 6:34077 (CONF-801011—(Vol.1))
**IODIDES**
**Chemical Reactions**
Ammonium iodide-potassium iodide mixed crystals in equilibrium with aqueous and aqueous-2-propanol solutions, 6:33596
**IODINE**
**Vibrational States**
New techniques in atomic and molecular laser spectroscopy, 6:33600
**IODINE 128**
**Radiation Monitoring**
Evaluation of airborne radioactive Iodine and noble gas environmental monitors using short-lived research reactor-produced radionuclides, 6:33765 (CONF-800433—)
**IODINE 129**
**Radiation Monitoring**
Environmental concentration and migration of $^{129}I$, 6:33767 (PNL-SA—9140)
**IODINE 131**
**Biological Radiation Effects**
Population dose estimation from a hypothetical release of 2.4 x $10^6$ curies of noble gases and 1 x $10^4$ curies of $^{131}I$ at the Three Mile Island Nuclear Station, Unit 2, 6:33361 (ORNL/TM—7980)
**Environmental Exposure Pathway**
Population dose estimation from a hypothetical release of 2.4 x $10^6$ curies of noble gases and 1 x $10^4$ curies of $^{131}I$ at the Three Mile Island Nuclear Station, Unit 2, 6:33361 (ORNL/TM—7980)
**ION BEAM TYPE REACTORS**
*See I-BEAM TYPE REACTORS*
**ION BEAMS**
**Acceleration**
Design features and focal properties of simple three element two- or three-dimensional lens systems for decelerating intense ion beams to very low energies, 6:33668

**ION CYCLOTRON RESONANCE SPECTROSCOPY**
**Research Programs**
Application of ion cyclotron resonance spectroscopy, photoionization mass spectrometry and photoelectron spectroscopy to study the properties and reactions of ions in gases, 6:33588 (CALT—767P8-8)

**ION EXCHANGE CHROMATOGRAPHY**
Ion chromatography with low-capacity resins and low-conductivity eluents, 6:33571

**ION SOURCES**
**Beam Extraction**
Improved extraction of negative ion beams from the inverted sputter source, 6:33677
**Design**
Electrode design and performance of the ORNL positive ion sources, 6:34181 (ORNL/TM—7879)
**Efficiency**
Electrode design and performance of the ORNL positive ion sources, 6:34181 (ORNL/TM—7879)

**ION-ATOM COLLISIONS**
**Charge Exchange**
One and a half centered expansion for ion-atom collisions, 6:33954 (CONF-800859—8)

**IONIZATION CHAMBERS**
**Calibration**
Optimal calibration of nuclear instrumentation, 6:33332 (CONF-810606—72)
**Design**
Hand and shoe monitor using air ionization probes (Patent), 6:33693

**IONIZING RADIATIONS**
**Biological Radiation Effects**
Problems in evaluating health effects of occupational and environmental exposures, 6:33891 (PNL-SA—9632)

**IRELAND**
**Wind Power**
Estimation of the parameters of the distribution of wind speed and direction, 6:33250

**IRIDIUM ALLOYS**
**Impact Strength**
Thorium doped iridium alloy for radioisotope heat sources (Patent), 6:33536

**IRON**
**Catalytic Effects**
Role of fly ash in the catalytic oxidation of $SO_2$, 6:33752 (LBL—11986)
**Embrittlement**
Relative effects of S, Sb and P on the intergranular fracture of iron and nickel tested at cathodic potentials, 6:33531 (PNL-SA—9446)
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Thermodynamic Properties**
Shock-compression measurements at pressures greater than 1 TPa, 6:33521 (LA-UR—81-2426)

**IRON 56 TARGET**
**Electron Reactions**
Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)

**IRON ALLOYS**
**Amorphous State**
Structural relaxation rates in amorphous Metglas alloys $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_{80}B_{80}$, 6:33523 (LA-UR—81-2444)
**Corrosion**
Corrosion of Fe alloys in NaNo/sub 3/-KNO/sub 3/-NaNO/sub 2/ at 823 K, 6:33148
**Crystal-Phase Transformations**
Soft phonons and magnetic ordering in the γ-phase transition metal alloys Fe/sub 1-x/Pd/sub x/, 6:34043 (BNL—30037)
**Diffusion**
Zero-flux planes and flux reversals in multicomponent diffusion. Progress report, January 1, 1981-August 31, 1981 (Cu-Ni-Zn; Fe-Ni-Cr), 6:33508 (DOE/ER/10814—1)
**Electric Conductivity**
Structural relaxation rates in amorphous Metglas alloys $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_{80}B_{80}$, 6:33523 (LA-UR—81-2444)
**Magnetization**
Soft phonons and magnetic ordering in the γ-phase transition metal alloys Fe/sub 1-x/Pd/sub x/, 6:34043 (BNL—30037)
**Mechanical Structures**
Magnetic fusion energy, 6:33526 (LBL—12000)
**Microstructure**
Magnetic fusion energy, 6:33526 (LBL—12000)

**IRON COMPLEXES**
**Chemical Reactions**
Mechanistic studies of carbon monoxide reduction. Progress report, August 1, 1980-August 1, 1981, 6:33080 (DOE/ER/10345—2)
**Structural Chemical Analysis**
Mechanistic studies of carbon monoxide reduction. Progress report, August 1, 1980-August 1, 1981, 6:33080 (DOE/ER/10345—2)

**IRON IONS**
**Ion-Molecule Collisions**
Gas-phase reactions of $Fe^+$ with ketones and ethers, 6:33960

**IRON OXIDES**
*See also MAGNETITE*
**Catalytic Effects**
Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)
Exploratory study of coal-conversion chemistry. Quarterly report No. 9, March 20, 1980-June 19, 1980, 6:32816 (DOE/ET/14855—9)
Exploratory study of coal-conversion chemistry. Quarterly report, December 20, 1979-March 19, 1980, 6:32815 (DOE/ET/14855—6)
Exploratory study of coal-conversion chemistry. Quarterly report, June 20, 1980-September 19, 1980, 6:32817 (DOE/ET/14855—12)
**Recovery**
Evaluation of potential processes for recovery of metals from coal ash. Final report, 6:33469 (EPRI-CS—1992(Vol.1))

**IRON SULFIDES**
*See also PYRITE*
**Chemical Reactions**
CaO interactions in the staged combustion of coal. Third quarterly technical progress report, April 1, 1981-June 30, 1981 (Reaction with $FeS_2$ and with sulfur), 6:32946 (DOE/PC/30301—3)

**ISABELLE STORAGE RINGS**
**Multiparticle Spectrometers**
Multiparticle magnetic spectrometer with dE/dx and TRD particle identification, 6:33669 (BNL—29990)

**Superconducting Magnets**
Analysis of cooldown performance for ISABELLE helium refrigerator, 6:33681 (BNL—30009)
Cycle design for the ISABELLE helium refrigerator, 6:33679 (BNL—30006)
Design of 24.8-kW, 3.8 K cryogenic system for ISABELLE, 6:33684 (BNL—30013)
Heat-load measurement of prototype cryogenic magnets and leads for the ISABELLE project, 6:33682 (BNL—30010)
MAGCOOL: the production cooling facility for ISABELLE magnets, 6:33683 (BNL—30011)
Production and use of high-grade silicon-diode temperature sensors, 6:33678 (BNL—30005)
Transient response of a thermal buffer: a study for ISABELLE, 6:33680 (BNL—30008)

**ISLANDS**
*See also GUAM*
*MARSHALL ISLANDS*
**Appropriate Technology**
Appropriate energy technology in the US Pacific territories, 6:33389

**ISOTOPE DATING**
**Feasibility Studies**
Laser isotope dating: a new technique of radioisotope dating using lasers, 6:33791 (CONF-800433—)

**ISX TOKAMAK**
**Electric Arcs**
High-speed photographic observation of plasma-limiter interactions in ISX-B, 6:34056 (CONF-810831—52)

**IUS**
*See TOTAL ENERGY SYSTEMS*

## J

**JAILS**
*See PUBLIC BUILDINGS*

**JET ENGINE FUELS**
**Liquid Column Chromatography**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**NMR Spectra**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)

**JEZEBEL REACTOR**
**Reactor Kinetics**
ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)

**JT-60 REACTORS**
**Reviews**
JT-60 project and its present status, 6:34156 (CONF-801011—(Vol.3))

## K

**KANSAS**
**Geochemical Surveys**
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)

**KAON MINUS-PROTON INTERACTIONS**
**Inclusive Interactions**
Inclusive $\pi 0$ and eta production from kaon, proton and antiproton beams in the triple-Regge region, 6:33972

**KAON PLUS-PROTON INTERACTIONS**
**Inclusive Interactions**
Inclusive $\pi^0$ and eta production from kaon, proton and antiproton beams in the triple-Regge region, 6:33972

**KAONS PLUS**
**Particle Decay**
Search for the violation of time-reversal invariance in K/sub $\mu 3$/ decays, 6:33965 (BNL—30026)

**KETONES**
**Ion-Molecule Collisions**
Gas-phase reactions of $Fe^+$ with ketones and ethers, 6:33960
**Liquid Column Chromatography**
Liquid-liquid chromatography fractionation of organic compounds in complex mixtures: application to automobile exhaust, 6:33575 (IS-T—914)

**KIDNEYS**
**Biological Radiation Effects**
Abstracts of twenty-ninth annual meeting of the Radiation Research Society, Minneapolis, Minnesota, 31 May-4 June 1981 (Lead abstract), 6:33897
**PIXE Analysis**
Trace element analysis of wild rodent tissues using the PIXE method, 6:33775 (CONF-800433—)
**Quantitative Chemical Analysis**
In vivo measurement of cadmium in an occupationally-exposed population, 6:33905 (CONF-800433—)

**KLYSTRONS**
**Electrical Testing**
Study of the emission performance of high-power klystrons: SLAC XK-5, 6:33673 (SLAC-TN—81-5)
**Performance Testing**
Study of the emission performance of high-power klystrons: SLAC XK-5, 6:33673 (SLAC-TN—81-5)

**KNOCK-ON ELECTRONS**
*See ELECTRONS*

**KOPPERS-TOTZEK PROCESS**
**Comparative Evaluations**
Low/medium-Btu coal-gasification assessment of central plant for the city of Philadelphia, Pennsylvania, 6:32836 (DOE/RA/20222—2)

**KRYPTON 86 REACTIONS**
**Deep Inelastic Heavy Ion Reactions**
Gamma-ray multiplicity moments from $^{86}$Kr reactions on $^{144}$sup(,)$^{154}$Sm at 490 MeV, 6:34016

## L

**LABOR**
**Productivity**
Analysis of the labor productivity decline in the U.S. bituminous coal mining industry. Final technical report , 6:32906 (DOE/ET/10033—T2)

**LAKES**
**Bioassay**
Water analysis methods at the integrated Lake Watershed Acidification Study Laboratory, Raquette Lake, NY, 6:33809 (BNL—51396)
**Chemical Analysis**
Water analysis methods at the integrated Lake Watershed Acidification Study Laboratory, Raquette Lake, NY, 6:33809 (BNL—51396)
**Water Chemistry**
Water analysis methods at the integrated Lake Watershed Acidification Study Laboratory, Raquette Lake, NY, 6:33809 (BNL—51396)

**LAMPF LINAC**
**Experiment Planning**
Future LAMPF experiments on lepton-number nonconservation, 6:33983 (LA-UR—81-2635)
**Manipulators**
Why high-capacity manipulators and lead glass windows, 6:33671 (LA-UR—81-2571)
**Research Programs**
Very-high-energy nuclear physics. Progress report, July 1, 1980-June 30, 1981, 6:33968 (DOE/ER/04660—1)

**LAND RECLAMATION**
Land resources, 6:33808 (DOE/EP/10012—1)

**Cost**
Comparison of reclamation costs: West and Midwest, 6:32958 (ANL/LRP-TM—20)
Costs of recontouring abandoned mined land, 6:32891 (ANL/LRP-TM—20)
Economic considerations of reclaiming abandoned tailings ponds and dams, 6:32892 (ANL/LRP-TM—20)
Northern Great Plains reclamation cost projections by computer, 6:32889 (ANL/LRP-TM—20)
Performance bonding impact upon the cost of reclamation of coal mines lands, 6:32956 (ANL/LRP-TM—20)
Valuation of surface mining design to improve post-mining land resources, 6:32886 (ANL/LRP-TM—20)
**Cost Benefit Analysis**
Evaluation of the potential of alternative land use plans for surface mined land, 6:32887 (ANL/LRP-TM—20)
Reclamation in the big sky, 6:32957 (ANL/LRP-TM—20)
**Earthmoving Equipment**
Dragline reclamation of abandoned contour mines, 6:32890 (ANL/LRP-TM—20)
**Economic Analysis**
Economics of reclamation, 6:32881 (ANL/LRP-TM—20)
Economics of surface mine reclamation, 6:32883 (ANL/LRP-TM—20)
Reclamation versus land use transformation: a cost comparison, 6:32885 (ANL/LRP-TM—20)
**Economics**
Analytical overview of practices, costs, and interdisciplinary relationships and trade-offs for reclamation planning in the coal industry with applications to non-coal, 6:32888 (ANL/LRP-TM—20)
Proceedings: conference on the economics of mined-land reclamation, 6:32880 (ANL/LRP-TM—20)
**Evaluation**
Analysis of post-restoration agricultural management at the Iowa coal project demonstration mine, 6:32884 (ANL/LRP-TM—20)
**Feasibility Studies**
Economic considerations of reclaiming abandoned tailings ponds and dams, 6:32892 (ANL/LRP-TM—20)
Reclamation versus land use transformation: a cost comparison, 6:32885 (ANL/LRP-TM—20)
**Insurance**
Performance bonding impact upon the cost of reclamation of coal mines lands, 6:32956 (ANL/LRP-TM—20)
**Legal Aspects**
Economics of reclamation, 6:32881 (ANL/LRP-TM—20)
**Meetings**
Proceedings: conference on the economics of mined-land reclamation, 6:32880 (ANL/LRP-TM—20)
**Planning**
Valuation of surface mining design to improve post-mining land resources, 6:32886 (ANL/LRP-TM—20)
**Public Opinion**
Public myths about reclamation, 6:32882 (ANL/LRP-TM—20)

**LAND USE**
**Comparative Evaluations**
Evaluation of the potential of alternative land use plans for surface mined land, 6:32887 (ANL/LRP-TM—20)
Northern Great Plains reclamation cost projections by computer, 6:32889 (ANL/LRP-TM—20)
**Economic Analysis**
Reclamation versus land use transformation: a cost comparison, 6:32885 (ANL/LRP-TM—20)
**Economics**
Analysis of post-restoration agricultural management at the Iowa coal project demonstration mine, 6:32884 (ANL/LRP-TM—20)
**Feasibility Studies**
Reclamation versus land use transformation: a cost comparison, 6:32885 (ANL/LRP-TM—20)
**Legal Aspects**
Zoning lands unsuitable for surface coal mining: an economic review, 6:32955 (ANL/LRP-TM—20)

**LANDFILLS**
*See SANITARY LANDFILLS*

**LANTHANIDES**
*See RARE EARTHS*

**LANTHANUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)

**LANTHANUM ALLOYS**
**Hydridation**
Hydride chemical compressor. Phase I, final report, 6:33631 (BNL—51369)

**LANTHANUM COMPOUNDS**
**Photosensitivity**
Effects of ion implantation on the photoferroelectric properties of lead lanthanum zirconate titanate ceramics, 6:33561 (SAND—81-1834C)

**LARGE COIL PROGRAM**
**Materials Testing**
Structural materials for large superconducting magnet systems: an assessment based on the large coil program, 6:34136 (CONF-801011—(Vol.2))

**LASER FUSION REACTORS**
*See also HYLIFE CONVERTER*
**Breeding Blankets**
Experimental investigation of the convective heat transfer characteristics of particle-bed type fusion blankets, 6:34144 (CONF-801011—(Vol.3))
Neutronic and thermal performance of a blanket design for an inertially confined fusion commercial power reactor, 6:34141 (CONF-801011—(Vol.3))
**Design**
Comparison of wetted-wall and magnetically protected-wall inertial fusion hybrid concepts, 6:34123 (CONF-801011—(Vol.2))
**Fiber Optics**
Streak camera measurements of laser pulse temporal dispersion in short graded-index optical fibers, 6:34185 (UCID—19176)
**First Wall**
Stability of the lithium waterfall first wall protection concept for inertial confinement fusion reactors, 6:34140 (CONF-801011—(Vol.3))
**Parametric Analysis**
Parametric systems analysis for ICF hybrid reactors, 6:34115 (CONF-801011—(Vol.2))
**Planning**
Utility perspective on inertial confinement fusion electric power generating plants, 6:34105 (CONF-801011—(Vol.2))
**Research Programs**
Inertial fusion program, January 1-June 30, 1979, 6:34175 (LA—8114-PR)

**LASER IMPLOSIONS**
**Recombination**
Survey of atomic physics issues in experimental inertial confinement research, 6:34184 (SAND—81-1864C)
**Spectroscopy**
Survey of atomic physics issues in experimental inertial confinement research, 6:34184 (SAND—81-1864C)

**LASER ISOTOPE SEPARATION**
Advanced isotope separation technology, 6:33612 (LBL—12000)

**LASER MIRRORS**
**Antireflection Coatings**
Antireflecting film development. Final report (For resisting damage from laser pulses), 6:33563 (UCRL—15373)

**Opacity**
Development of uv-transparent fluorophosphate glass. Final report, July 10, 1980-January 10, 1981, 6:33564 (UCRL—15375)
**Production**
Development of uv-transparent fluorophosphate glass. Final report, July 10, 1980-January 10, 1981, 6:33564 (UCRL—15375)

**LASER RADIATION**
**Radiation Detection**
Laser pulse detector (Patent), 6:33650

**LASER SPECTROSCOPY**
Two-laser induced selective infrared-visible fluorescence for thin film analysis, 6:33584
**Comparative Evaluations**
Intercomparison of the integrating plate and the laser transmission methods for determination of aerosol absorption coefficients, 6:33754 (LBL—11986)
**Uses**
New techniques in atomic and molecular laser spectroscopy, 6:33600

**LASER TARGETS**
**Fabrication**
Calculations of DT fill times and time-temperature behavior during injection for some representative ICF pellets, 6:33063 (CONF-801011—(Vol.1))
**Microspheres**
Apparatus for electroplating particles of small dimension (Patent), 6:33567
**Research Programs**
Inertial fusion program, January 1-June 30, 1979, 6:34175 (LA—8114-PR)
**Thermonuclear Reactor Materials**
Apparatus for electroplating particles of small dimension (Patent), 6:33567

**LASER-PRODUCED PLASMA**
**Plasma Diagnostics**
Design of neutron streak camera for fusion diagnostics, 6:34072 (UCRL—86162)

**LASERS**
*See also CARBON DIOXIDE LASERS*
*DYE LASERS*
*FREE ELECTRON LASERS*
*GAS LASERS*
*NEODYMIUM LASERS*
**Efficiency**
Phoenix II energy extraction and angular multiplexing experiments, 6:34183 (SAND—81-1472)

**LATENT HEAT STORAGE**
Conceptual design selection and development of a latent-heat thermal-energy-storage subsystem for a saturated-steam solar receiver and load, 6:33201 (SAND—81-8184)
**Direct Contact Heat Exchangers**
Design and economics of direct-contact salt hydrate storage systems, 6:33203 (SERI/TP—631-1163)

**LATTICE FIELD THEORY**
**Computerized Simulation**
Numerical studies of gauge field theories, 6:33987 (BNL—29840)
**Four-Dimensional Calculations**
Phase transitions and variant actions in lattice gauge theory, 6:33986 (BNL—29823)
**Phase Diagrams**
Phase transitions and variant actions in lattice gauge theory, 6:33986 (BNL—29823)

**LATTICES (CRYSTAL)**
*See CRYSTAL LATTICES*

**LAUNDRIES**
**Solar Water Heating**
Solar energy system performance evaluation: Aratex Services, Fresno, California, December 1979-November 1980, 6:33190 (SOLAR/2008—81/14)

**LAWRENCIUM**
**Chemical Properties**
Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:33624
**Chemistry**
Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:33624

**LEACHATES**
**Chemical Composition**
Investigations of Occidental Oil Shale, Inc., retort 3E spent shales, 6:32995 (LA—8792-MS)

**LEAD**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)

**LEAD 188**
**Alpha Decay**
$\alpha$-decay rate of $^{188}$Pb, 6:34024

**LEAD 206 TARGET**
**Lithium 6 Reactions**
Elastic and inelastic scattering of 88 MeV $^{6}$Li ions, 6:34013

**LEAD 208 TARGET**
**Carbon 12 Reactions**
Two-proton correlation measurements in 800 and 400 MeV/nucleon heavy-ion reactions, 6:34008
**Electron Reactions**
Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)
**Lithium 6 Reactions**
Elastic and inelastic scattering of 88 MeV $^{6}$Li ions, 6:34013
**Proton Reactions**
Energy systematics of the giant Gamow-Teller resonance and a charge-exchange dipole spin-flip resonance, 6:34020

**LEAD 210**
**Environmental Transport**
Determination of $^{210}$Pb and $^{210}$Po in the environment, 6:33799 (CONF-800433—)
Model for Pb-210 in sediments influenced by mixing and compaction, 6:33796 (CONF-800433—)

**LEAD COMPLEXES**
**Chemical Reaction Yield**
Nuclear waste management, 6:33589 (LBL—12000)

**LEAD COMPOUNDS**
**Photosensitivity**
Effects of ion implantation on the photoferroelectric properties of lead lanthanum zirconate titanate ceramics, 6:33561 (SAND—81-1834C)

**LEAD METHOD**
*See ISOTOPE DATING*

**LEAVES**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Multi-Element Analysis**
Feasibility of trace multielement analysis by 14-MeV neutron activation, 6:33787 (CONF-800433—)

**LEPTON NUMBER**
**Conservation Laws**
Future LAMPF experiments on lepton-number nonconservation, 6:33983 (LA-UR—81-2635)

**LEUKEMIA VIRUS**
*See ONCOGENIC VIRUSES*

**LI-DRIFTED GE DETECTORS**
**Accuracy**
Precision energy measurement of $\gamma$ rays from short-lived activities, 6:34009

**LIFE SPAN**
**Delayed Radiation Effects**
Experimental radiation carcinogenesis: what have we learned ($^{60}$Co; fission neutrons; mice), 6:33895
**Genetics**
Mammalian life histories: their evolution and molecular-genetic mechanisms, 6:33881
**Ontogenesis**
Mammalian life histories: their evolution and molecular-genetic mechanisms, 6:33881

**LIGHT**
*See VISIBLE RADIATION*
**LIGHTING SYSTEMS**
**Energy Efficiency**
Energy-efficient lighting program, 6:33454 (LBL—11985)
**Research Programs**
Energy-efficient lighting program, 6:33454 (LBL—11985)
**LIGNIN**
**Biodegradation**
Degradation of softwood, hardwood, and grass lignocelluloses by two Steptomyces strains, 6:33872
**LIMESTONE**
Hydration enhanced sulfation of limestone and dolomite in the fluidized-bed combustion of coal, 6:32954
**LIMITERS**
**Coatings**
Performance of TiC-coated graphite in electron-beam tests and Doublet III operation, 6:34172 (GA-A—16384)
Status of low Z coatings for fusion reactor applications, 6:34134 (CONF-801011—(Vol.2))
**Test Facilities**
Electric field bumpy torus plasma as a test bed for plasma-wall interaction studies, 6:34145 (CONF-801011—(Vol.3))
**Vacuum Pumps**
Novel limiter pump topologies, 6:34171 (DOE/ET/51013—6)
**LINACS**
*See LINEAR ACCELERATORS*
**LINEAR ACCELERATORS**
*See also FMIT LINAC*
*LAMPF LINAC*
*ORELA*
**Beam Emittance**
Beam emittance growth caused by transverse deflecting fields in a linear accelerator, 6:33666
**LINUS REACTORS**
**Radioactive Waste Management**
Long-term toxicity reduction using an imploding liner reactor as a waste transmuter, 6:33067 (CONF-801011—(Vol.2))
**LIPIDS**
*See also PHOSPHOLIPIDS*
**Biosynthesis**
Enzymatic synthesis of 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine, a hypotensive and platelet-aggregating lipid, 6:33850
**LIQUID ASPHALT**
*See RESIDUAL FUELS*
**LIQUID METAL FAST BREEDER REACTORS**
*See LMFBR TYPE REACTORS*
**LIQUID METAL TEST FACILITIES**
*See TEST FACILITIES*
**LIQUID METAL-WATER REACTIONS**
*See MOLTEN METAL-WATER REACTIONS*
**LIQUIDS**
**Neutron Diffraction**
Instrument for liquids, amorphous and power diffraction, 6:33578 (LA-UR—81-2531)
**Reflectivity**
Experimental design for reflection measurements of highly reactive liquid or solid substances with application to liquid sodium, 6:33345 (DOE/ET/37227—T2)
**LITEK LAMP**
*See FLUORESCENT LAMPS*
**LITHIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
**LITHIUM 6 REACTIONS**
**Elastic Scattering**
Elastic and inelastic scattering of 88 MeV $^{6}$Li ions, 6:34013
**LITHIUM COMPOUNDS**
Use of alkali metal-acid phosphates for elevated temperature water electrolysis, 6:33077 (UCRL—86623)
**Bibliographies**
Survey of lithium compounds for tritium breeding applications, 6:34133 (CONF-801011—(Vol.2))
**Neutron Reactions**
Survey of lithium compounds for tritium breeding applications, 6:34133 (CONF-801011—(Vol.2))
**LITHIUM FLUORIDES**
**Neutron Reactions**
Neutron spectra and tritium production rate measurements in the one dimensional LiF slab geometry as a fusion reactor blanket benchmark experiment, 6:34090 (CONF-801011—(Vol.1))
**LIVER**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Multi-Element Analysis**
Feasibility of trace multielement analysis by 14-MeV neutron activation, 6:33787 (CONF-800433—)
Influence of post mortem changes on the elemental composition of rat liver studied by atomic absorption spectrometry and neutron activation analysis, 6:33880 (CONF-800433—)
**PIXE Analysis**
Trace element analysis of wild rodent tissues using the PIXE method, 6:33775 (CONF-800433—)
**Quantitative Chemical Analysis**
In vivo measurement of cadmium in an occupationally-exposed population, 6:33905 (CONF-800433—)
**LMFBR TYPE REACTORS**
*See also CLINCH RIVER BREEDER REACTOR*
*EBR-2 REACTOR*
*PHENIX REACTOR*
Contribution of Clinch River Breeder Reactor plant design and development to the LMFBR fuel cycle, 6:33302 (CONF-810941—1)
**Alloy Nuclear Fuels**
Development and performance of metal fuel elements for fast breeder reactors, 6:33316
**Containment Buildings**
Evaluation of high-pressure containment buildings for LMFBR's (1000 MW(e); consequence mitigation), 6:33359 (HEDL-SA—2292-FP)
**Fuel Assemblies**
TCLUST1: a computer program for analysis of intersubassembly heat transfer in an LMFBR, 6:33301 (ANL—81-18)
**Fuel Cans**
High rate transient mechanical properties of unirradiated fast reactor cladding, 6:33358 (HEDL-SA—2288-S)
**Fuel Element Failure**
LMFBR fuel-design environment for endurance testing, primarily of oxide fuel elements with local faults, 6:33303 (CONF-8008111—1)

**Fuel Pins**
Fuel pin behavior under slow overpower transient conditions; HEDL W-2 SLSF experiment results, 6:33357 (HEDL-SA—2284-FP)
LMFBR fuel-design environment for endurance testing, primarily of oxide fuel elements with local faults, 6:33303 (CONF-8008111—1)
**Fuel-Coolant Interactions**
High temperature chemomechanical interactions between alkali metals and urania-base oxide reactor fuels, 6:33308 (GEFR-SP—236)
**Heat Transfer**
Manual for use with the computer code SUPERENERGY: data reduction version, 6:33304 (DOE/ET/37240—74TR)
**Hydraulics**
Manual for use with the computer code SUPERENERGY: data reduction version, 6:33304 (DOE/ET/37240—74TR)
**Loss of Coolant**
Sodium boiling and mixed oxide fuel thermal behavior in FBR undercooling transients; W-1 SLSF experiment results, 6:33354 (HEDL-SA—2263-FP)
**Loss of Flow**
Parametric study of multichannel molten cladding motion under unprotected loss-of-flow accident conditions in LMFBR's, 6:33366
**Primary Coolant Circuits**
Thermal-hydraulic differential sensitivity theory, 6:33312 (ORNL/CSD/TM—126)
**Reactor Core Disruption**
Experimental studies in CDA work-energy attenuation. Quarterly technical progress report No. 22, 1 April- 30 June 1980, 6:33347 (DOE/SF/70097—T8)
General formulation of an HCDA bubble rising in a sodium pool and the effect of nonequilibrium on fuel transport, 6:33344 (DOE/ET/37227—T1)
**Reactor Kinetics**
Manual for use with the computer code SUPERENERGY: data reduction version, 6:33304 (DOE/ET/37240—74TR)
**Reactor Materials**
Analysis of potential attack on insulating materials exposed to sodium. Final report, 6:33306 (EPRI-NP—1986)
Designing against low-cycle fatigue at elevated temperature, 6:33315
**Steam Generators**
Pressure transient analysis of elbow-pipe experiments using the PTA-2 computer code, 6:33364
**Thermal Insulation**
Analysis of potential attack on insulating materials exposed to sodium. Final report, 6:33306 (EPRI-NP—1986)
**Transient Overpower Accidents**
Fuel pin behavior under slow overpower transient conditions; HEDL W-2 SLSF experiment results, 6:33357 (HEDL-SA—2284-FP)
High rate transient mechanical properties of unirradiated fast reactor cladding, 6:33358 (HEDL-SA—2288-S)
Internal fuel motion as an inherent shutdown mechanism for LMFBR accidents: PINEX-3, PINEX-2, and HUT 5-2A experiments, 6:33355 (HEDL-SA—2264-FP)
**Transients**
Transient redistribution of intragranular fission gas in irradiated mixed oxide, 6:33356 (HEDL-SA—2272)

**LOAD ANALYSIS**
**Forecasting**
Regional load-curve models: QUERI's model specification, estimation and validation. Final report, 6:33421 (EPRI-EA—1672(Vol.2))
**Regional Analysis**
Regional load-curve models: QUERI's model specification, estimation and validation. Final report, 6:33421 (EPRI-EA—1672(Vol.2))
**Simulation**
Regional load-curve models: QUERI's model specification, estimation and validation. Final report, 6:33421 (EPRI-EA—1672(Vol.2))

**LOAD MANAGEMENT**
**Control Systems**
Selective load control for industrial customers, 6:33264 (ORNL/Sub—7399/1)

**LONG VALLEY**
**Geophysical Surveys**
Comparative assessment of five potential sites for magma: hydrothermal systems - geophysics, 6:33221 (UCRL—52980)
**Resource Assessment**
Comparative assessment of five potential sites for magma: hydrothermal systems - geophysics, 6:33221 (UCRL—52980)
**Temperature Surveys**
Airborne and field-temperature surveys compared at Long Valley KGRA, California, 6:33222 (UCRL—86148)

**LONGWALL MINING**
**Engineering Geology**
Geomechanical considerations related to the choice of a working floor for a proposed longwall development, 6:32921
**Floors**
Geomechanical considerations related to the choice of a working floor for a proposed longwall development, 6:32921
**Ground Subsidence**
Subsidence prediction and control. Phase I. The state of knowledge in Poland concerning the influence of mining exploitation on the surface. Final report, 6:32911 (DOE/TIC—11481)
**Mining Equipment**
Development of a longwall water jet mining machine. Final technical report, 6:32909 (DOE/ET/12542—T1)
**Powered Supports**
Method of investigations, estimation, and classification of roofs in mines in the United States of America for the selection of suitable mechanized support for longwalls. Report No. 1: January 1, 1977-March 31, 1977, 6:32910 (DOE/TIC—11477)
Support selection for the multi-lift mining method (Thick seams), 6:32903 (CONF-810714—3)
**Roofs**
Method of investigations, estimation, and classification of roofs in mines in the United States of America for the selection of suitable mechanized support for longwalls. Report No. 1: January 1, 1977-March 31, 1977, 6:32910 (DOE/TIC—11477)
**Shearer Loaders**
Mine demonstrations of longwall dust control techniques. Technical status report, July 31, 1981-August 31, 1981, 6:32908 (DOE/ET/12532—T4)

**LOS ALAMOS MESON PHYSICS FACILITY**
*See LAMPF LINAC*

**LOSS OF COOLANT**
**Heat Transfer**
Posttest analysis of international standard problem 10 using RELAP4/MOD7 (PWR), 6:33341 (CONF-810606—73)
Sodium boiling and mixed oxide fuel thermal behavior in FBR undercooling transients; W-1 SLSF experiment results, 6:33354 (HEDL-SA—2263-FP)
**Hydraulics**
Posttest analysis of international standard problem 10 using RELAP4/MOD7 (PWR), 6:33341 (CONF-810606—73)
Sodium boiling and mixed oxide fuel thermal behavior in FBR undercooling transients; W-1 SLSF experiment results, 6:33354 (HEDL-SA—2263-FP)
**Pressure Gradients**
Analysis of short-term reactor cavity transient (PWR; BWR), 6:33342 (CONF-810606—74)
**Test Facilities**
Sodium boiling and mixed oxide fuel thermal behavior in FBR undercooling transients; W-1 SLSF experiment results, 6:33354 (HEDL-SA—2263-FP)
**Void Fraction**
Experimental investigations of two-phase mixture level swell and axial void fraction distribution under high pressure, low heat flux conditions in rod bundle geometry, 6:33343 (CONF-810806—8)

**LOSS OF FLOW**
**Simulation**
Loss-of-feed water transients in PWR U-tube steam generators: simulation experiments and analysis, 6:33367
**LOW BTU GAS**
**Chemical Analysis**
Automated on-line determination of PPB levels of sodium and potassium in low-Btu coal gas and fluidized bed combustor exhaust by atomic emission spectrometry, 6:32861 (IS-M—330)
**Combustion**
Controlled combustion of a varying low-btu coal-derived gas, 6:32952
**LOW INCOME GROUPS**
**Weatherization**
Energy savings from the Minnesota low-income weatherization programme, 6:33397
**LUNGS**
**Biological Radiation Effects**
Abstracts of twenty-ninth annual meeting of the Radiation Research Society, Minneapolis, Minnesota, 31 May-4 June 1981 (Lead abstract), 6:33897
Influence of noncarcinogenic secondary factors on radiation carcinogenesis (In vitro; hamsters; x ray), 6:33896
**Delayed Radiation Effects**
Experimental radiation carcinogenesis: what have we learned ($^{60}$Co; fission neutrons; mice), 6:33895
**PIXE Analysis**
Trace element analysis of wild rodent tissues using the PIXE method, 6:33775 (CONF-800433—)
**Quantitative Chemical Analysis**
Method of determining glass in rat lung after exposure to a glass fiber aerosol, 6:33914
**LURGI PROCESS**
Diffusion and reaction in a stagnant boundary layer about a carbon particle--6. effect of water vapor on the pseudo-steady-state structure, 6:32847
**Comparative Evaluations**
Low/medium-Btu coal-gasification assessment of central plant for the city of Philadelphia, Pennsylvania, 6:32836 (DOE/RA/20222—2)
**LURGI SLAGGING PROCESS**
**Demonstration Plants**
Pipeline-gas demonstration plant: Phase I. Construction planning. Volume 1: safety procedures, temporary facilities, and labor survey, 6:32856 (DOE/ET/13060—T9(Vol.2))
**LUTETIUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**LUTETIUM 176 TARGET**
**Triton Reactions**
$^{176}$Lu(t,p)$^{178}$Lu reaction. The influence of shell gaps and blocking on L = 0 strenght, 6:34026
**LUTETIUM 178**
**Energy Levels**
$^{176}$Lu(t,p)$^{178}$Lu reaction. The influence of shell gaps and blocking on L = 0 strenght, 6:34026
**LYMPHOCYTES**
**Biochemistry**
Two-dimensional analysis of human lymphocyte proteins: I. An assay for lymphocyte effectors, 6:33847
**Chromosomal Aberrations**
Microdosimetry of lymphocytes irradiated by alpha particles, 6:33890 (PNL-SA—9315)
**LYMPHOID CELLS**
*See LYMPHOCYTES*
**LYOLUMINESCENCE**
**Measuring Methods**
New technique of radiation dosimetry based on lyoluminescence, 6:33838 (CONF-800433—)

## M

**MA 754**
*See NICKEL BASE ALLOYS*
**MACHINE TOOLS**
**Computerized Control Systems**
Digital control of machine tools, 6:33642 (Y—2227)
Minicomputer and computer numerical control maintenance, 6:33643 (Y/IA—152)
**MACHINING**
*See also ELECTROCHEMICAL MACHINING*
**Automation**
Digital control of machine tools, 6:33642 (Y—2227)
**MAGNESIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Mass Spectroscopy**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
**MAGNESIUM 24 TARGET**
**Lithium 6 Reactions**
Elastic and inelastic scattering of 88 MeV $^{6}$Li ions, 6:34013
**MAGNESIUM 25 TARGET**
**Lithium 6 Reactions**
Elastic and inelastic scattering of 88 MeV $^{6}$Li ions, 6:34013
**MAGNESIUM 26 TARGET**
**Lithium 6 Reactions**
Elastic and inelastic scattering of 88 MeV $^{6}$Li ions, 6:34013
**MAGNESIUM ALLOYS**
**Physical Radiation Effects**
Microstructure and tensile properties of heavily irradiated 5052-0 aluminium alloy (Fast and thermal neutrons), 6:33538
**MAGNESIUM CHLORIDES**
**Physical Properties**
Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981, 6:33192 (DOE/CS/30174—T2Vol.1)
**MAGNESIUM COMPOUNDS**
**Oxidation**
Oxidation of metal sulfites by iodine for use in thermochemical hydrogen cycles, 6:33073 (LA-UR—81-2477)
**MAGNET COILS**
**Electric Arcs**
Analysis of the dynamic behavior of the electric arc for fusion magnet safety, 6:34088 (CONF-801011—(Vol.1))
**Stress Analysis**
Structural dynamics of toroidal field coil in magentic fusion reactor, 6:34085 (CONF-801011—(Vol.1))

**MAGNETIC BEARINGS**
**Design**
Magnetic bearings (Patent), 6:33646 (LA-tr—81-19)
**MAGNETIC COILS**
*See MAGNET COILS*
**MAGNETIC FIELDS**
**Trajectories**
Particle trajectories in quadrupole fringe fields, 6:33667
**MAGNETIC MIRROR CONFIGURATIONS**
**Charged-Particle Transport**
Generating end plug potentials in tandem mirror plasma confinement by heating thermal particles so as to escape low density end stoppering plasmas (Patent), 6:34190
**MAGNETIC MIRROR TYPE REACTORS**
*See also FIELD-REVERSED MIRROR REACTORS*
*TMR REACTORS*
**Design**
Design studies of commercial magnetic fusion reactors, 6:34170 (CONF-801011—(Vol.3))
**MAGNETIC REFRIGERATORS**
**Design**
4 K to 20 K rotational-cooling magnetic refrigerator capable of 1 mW to 'GT' 1 W operation, 6:33634
**MAGNETITE**
**Nuclear Magnetic Resonance**
Nuclear magnetic resonance method for observation of ferromagnetic pulmonary contaminants, 6:33906 (CONF-800433—)
**MAIZE**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**MALIGNANCIES**
*See NEOPLASMS*
**MAMMARY GLANDS**
**Delayed Radiation Effects**
Experimental radiation carcinogenesis: what have we learned ($^{60}$Co; fission neutrons; mice), 6:33895
**MANGANESE**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Mass Spectroscopy**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
**MANGANESE 55 TARGET**
**Neutron Reactions**
Neutron capture cross section standards for BNL 325, Fourth Edition, 6:34039 (BNL-NCS—51388)
**MANGANESE HYDRIDES**
**Hydrogen Storage**
Queries concerning local models for hydrogen uptake in metal hydrides, 6:33592
**Phase Transformations**
Queries concerning local models for hydrogen uptake in metal hydrides, 6:33592
**MANIPULATORS**
**Operation**
Why high-capacity manipulators and lead glass windows, 6:33671 (LA-UR—81-2571)
**MANUFACTURING FACILITIES**
*See INDUSTRIAL PLANTS*
**MARCOULE PHENIX REACTOR**
*See PHENIX REACTOR*
**MARINE DISPOSAL**
**Economic Analysis**
Coal waste artificial reef program, Phase 3. Volume 3. Engineering-economic evaluation of fixed coal waste block production and disposal. Final report, 6:32870 (EPRI-CS—2009(Vol.3))
**Feasibility Studies**
Coal waste artificial reef program, Phase 3. Volume 3. Engineering-economic evaluation of fixed coal waste block production and disposal. Final report, 6:32870 (EPRI-CS—2009(Vol.3))
**MARINE ECOSYSTEMS**
*See AQUATIC ECOSYSTEMS*
**MARSHALL ISLANDS**
**Radiation Monitoring**
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)
Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)
**MARYLAND**
**Coastal Regions**
Guide to Douglas Point, Charles County, Maryland, 6:33807 (DOE/SR/10018—5)
**MASKS**
*See RESPIRATORS*
**MASS SPECTROMETERS**
**Design**
Soot formation in synfuels. Second quarterly report, 1 January 1981-31 March 1981, 6:33083 (DOE/PC/30304—2)
**Optical Systems**
Soot formation in synfuels. Second quarterly report, 1 January 1981-31 March 1981, 6:33083 (DOE/PC/30304—2)
**Probes**
Soot formation in synfuels. Second quarterly report, 1 January 1981-31 March 1981, 6:33083 (DOE/PC/30304—2)
**MASSACHUSETTS**
**Coal Deposits**
Exploration of coal and anthracitic carbonaceous shale resources, Narragansett Basin, Massachusetts and Rhode Island. Final report, 1 October 1979-30 April 1981, 6:32899 (DOE/RA/20029—T1)
**Coal Mining**
Exploration of coal and anthracitic carbonaceous shale resources, Narragansett Basin, Massachusetts and Rhode Island. Final report, 1 October 1979-30 April 1981, 6:32899 (DOE/RA/20029—T1)
**MATERIALS**
*See also FERROELECTRIC MATERIALS*
*POROUS MATERIALS*
**Mechanical Properties**
Role of engineering judgement and the computer in the management of material property data, 6:33495 (CONF-800804—43)
**Physical Properties**
Role of engineering judgement and the computer in the management of material property data, 6:33495 (CONF-800804—43)
**Research Programs**
Materials and Molecular Research Division annual report 1980, 6:33496 (LBL—12000)
Materials chemistry, 6:34045 (LBL—12000)

Research in materials. Annual report, 6:33497

**MATERIALS (FERROELECTRIC)**
*See FERROELECTRIC MATERIALS*

**MATERIALS TESTING**
**Computer Calculations**
Finite element analysis of the split Hopkinson bar, 6:34044 (LA—8921-MS)
**Finite Element Method**
Finite element analysis of the split Hopkinson bar, 6:34044 (LA—8921-MS)

**MATRIX MATERIALS**
**Nondestructive Analysis**
Measurement of moisture depth distribution in composite materials using positron lifetime technique, 6:33789 (CONF-800433—)

**MEASURING METHODS**
**Surveys**
Survey of particulate emission macro- and micro-sampling and sizing methods and real-time monitoring and sizing methods, 6:33742 (DOE/FC/10193—T1)

**MECHANICAL PROPERTIES**
*See also COMPRESSION STRENGTH*
**Data Acquisition Systems**
Role of engineering judgement and the computer in the management of material property data, 6:33495 (CONF-800804—43)

**MELTDOWN**
**Molten Metal-Water Reactions**
Propagation of a liquid-liquid explosion, 6:33360 (LA—8971-MS)

**MEMBRANE TRANSPORT**
**Biochemistry**
Gradient coupling in isolated intestinal cells, 6:33853

**MENDELEVIUM**
**Chemical Properties**
Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:33624
**Chemistry**
Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:33624

**MENDELEVIUM 259**
**Fission Fragments**
Kinetic energy deficit in the symmetric fission of $^{259}$Md, 6:34030
**Spontaneous Fission**
Kinetic energy deficit in the symmetric fission of $^{259}$Md, 6:34030

**MENTAL DISORDERS**
**Pathology**
INAA studies of normal and diseased human brain, 6:33879 (CONF-800433—)

**MERCURY**
**Ecological Concentration**
Study of heavy elements (Cd, Hg and Se) in the aquatic environment around Bombay by radiochemical neutron activation analysis, 6:33814 (CONF-800433—)
**Ion Exchange Chromatography**
Chromatographic separation of metal ions on macroreticular anion-exchange resins of a low capacity, 6:33587

**MESSENGER-RNA**
**Structural Chemical Analysis**
Adenovirus type 2 early proteins: assignment of the early region 1A proteins synthesized in Vivo and in Vitro to specific mRNAs, 6:33874

**METAL-GAS BATTERIES**
*See also ALUMINIUM-AIR BATTERIES*
**Design**
Sodium chloride battery development program for load leveling. Interim report, January 1, 1975-December 31, 1975, 6:33263 (EPRI-EM—230)
**Performance Testing**
Sodium chloride battery development program for load leveling. Interim report, January 1, 1975-December 31, 1975, 6:33263 (EPRI-EM—230)

**METAL-NONMETAL BATTERIES**
**Design**
Calcium/metal sulfide battery development program. Progress report, October 1979-September 1980, 6:33376 (ANL—81-14)
**Performance Testing**
Calcium/metal sulfide battery development program. Progress report, October 1979-September 1980, 6:33376 (ANL—81-14)

**METALS**
*See also ACTINIDES*
*RARE EARTHS*
*TRANSITION ELEMENTS*
**Activation Analysis**
Analysis of non-metals in metals, 6:33543
**Autoradiography**
Tritium autoradiography, 6:33654 (DP-MS—81-12)
**Deposition**
Atmospheric deposition of heavy metals studied by analysis of moss samples using neutron activation analysis and atomic absorption spectrometry, 6:33729 (CONF-800433—)
**Detection**
Evaluation of active and passive near-millimeter-wave radiometric imaging techniques for detection of concealed objects, 6:33062 (SAND—81-1051)
**Ecological Concentration**
Radiochemical-NAA studies of biological samples in connection with marine production of petroleum, 6:33817 (CONF-800433—)
**Electronic Structure**
Proceedings of the interdisciplinary meeting on hydrogen in metals, 6:33503 (CONF-800280—)
**Embrittlement**
Proceedings of the interdisciplinary meeting on hydrogen in metals, 6:33503 (CONF-800280—)
**Mechanical Properties**
Analysis of non-metals in metals, 6:33543
Role of engineering judgement and the computer in the management of material property data, 6:33495 (CONF-800804—43)
**Meetings**
Analysis of non-metals in metals, 6:33543
Proceedings of the interdisciplinary meeting on hydrogen in metals, 6:33503 (CONF-800280—)
**Microstructure**
Interaction of stress with the martensitic phase transition in A15 compounds, 6:33500 (BNL—30016)
**Phase Transformations**
Interaction of stress with the martensitic phase transition in A15 compounds, 6:33500 (BNL—30016)
**Physical Properties**
Role of engineering judgement and the computer in the management of material property data, 6:33495 (CONF-800804—43)
**Research Programs**
Metals and Ceramics Division materials science program. Annual progress report for period ending June 30, 1981, 6:33529 (ORNL/TM—7970)
Research in materials. Annual report, 6:33497
**Stoichiometry**
Analysis of non-metals in metals, 6:33543
**Stress Corrosion**
Proceedings of the interdisciplinary meeting on hydrogen in metals, 6:33503 (CONF-800280—)
**Volatility**
Predictive calculations of volatilities of metals and oxides in steam-containing environments, 6:33055 (UCRL—85553)

**METHANE**
**Biosynthesis**
Bioconversion energy systems: new developments and opportunities, 6:33085
Hybrid biothermal conversion of biomass to methane, 6:33084
Kinetics of acid-phase fermentation in anaerobic digestion, 6:33086
**Production**
Advanced system experimental facility: solid waste to methane gas. Background and process description, 6:33079 (ANL/CNSV—22)

**Recovery**
High-pressure solvent extraction of methane from geopressured fluids, 6:33223 (UCRL—86515)
**Solvent Extraction**
High-pressure solvent extraction of methane from geopressured fluids, 6:33223 (UCRL—86515)
**Synthesis**
Hybrid biothermal conversion of biomass to methane, 6:33084

**METHANOL**
**Adsorption**
Oxidation of formic acid and methanol on single crystal platinum electrodes, 6:33605 (BNL—29817)
**Oxidation**
Oxidation of formic acid and methanol on single crystal platinum electrodes, 6:33605 (BNL—29817)
**Production**
Comparison of independent product cost estimates: the cost of methanol from coal, 6:32848

**METHYL METHANESULFONATE**
**Cell Killing**
Third-chromosome mutagen-sensitive mutants of Drosophila melanogaster, 6:33861
**Mutagenesis**
Spontaneous mitotic recombination in mms8-1, an allele of the CDC9 gene of Saccharomyces cerevisiae, 6:33873

**MEXICO**
**Natural Gas Deposits**
Comments on oil and gas reserves in Mexico, 6:33416 (EPRI-WS—79-182)
**Petrochemical Plants**
Planning an integrated Mexican petrochemical industry, 6:32979
**Petroleum Deposits**
Comments on oil and gas reserves in Mexico, 6:33416 (EPRI-WS—79-182)
Mexico's oil and gas: a realistic perspective, 6:33417 (EPRI-WS—79-182)
**Petroleum Industry**
Mexico's oil and gas: a realistic perspective, 6:33417 (EPRI-WS—79-182)

**MFTF DEVICES**
**Reviews**
Mirror fusion test facility-B, 6:34157 (CONF-801011—(Vol.3))
**Superconducting Magnets**
Evaluation of shielded metal arc and flux cored metal arc welding consumables for fabrication of stainless steel magnet cases for 4K service, 6:33640 (UCRL—85564)

**MHD POWER PLANTS**
**Design**
Conceptual design study of potential early commercial MHD powerplant. Final report of Task 2 results, 6:33435 (DOE/NASA/0051—2)
First-principle dynamic modeling of an MHD-steam coupled power plant, 6:33268
**Dynamics**
First-principle dynamic modeling of an MHD-steam coupled power plant, 6:33268
**Economic Analysis**
Conceptual design study of potential early commercial MHD powerplant. Final report of Task 2 results, 6:33435 (DOE/NASA/0051—2)
**Environmental Effects**
Environmental R and D needs for advanced power plants, 6:32895

**MICELLAR-POLYMER FLOODING**
*See MICROEMULSION FLOODING*

**MICHIGAN**
**Geochemical Surveys**
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Geothermal Resources**
Multi-task support to the Division of Geothermal Energy's hydrothermal resources program. Final report, 6:33206 (DOE/EV/10072—5)

**MICROCOSMS**
**Optimization**
Assessment of optimum aquatic microcosm design for pollution impact studies, 6:33821 (EPRI-EA—1989)

**MICROEMULSION FLOODING**
**Polymers**
Improved polymers for enhanced oil recovery: synthesis and rheology. Third annual report, October 1979-September 1980, 6:32968 (DOE/ET/12038—T3)

**MICROSEISM**
*See SEISMIC NOISE*

**MICROSPHERES**
**Electroplating**
Apparatus for electroplating particles of small dimension (Patent), 6:33567

**MIDDLE DISTILLATES**
*See PETROLEUM DISTILLATES*

**MIDDLE EAST**
**Foreign Policy**
Perspective on individual regions: the Middle East, 6:33415 (EPRI-WS—79-182)

**MIDWEST REGION**
*See also KANSAS*
*NEBRASKA*
**Biomass**
Wood resources and utilization patterns in the North Central Region and energy needs for the manufacture of wood products, 6:33114 (MASEC/R—81-005)

**MIGRATION (RADIONUCLIDE)**
*See RADIONUCLIDE MIGRATION*

**MILITARY PERSONNEL**
**Whole-Body Counting**
Radioactivity measurements of former military personnel exposed to weapon debris, 6:33892

**MILK**
**Radiation Monitoring**
Environmental monitoring in the vicinity of the Savannah River Plant. Annual report, 1980, 6:33801 (DPSPU—81-30-1)

**MILL TAILINGS**
**Biogeochemistry**
Biogeochemistry of uranium mill wastes program overview and conclusions, 6:33035 (LA—8861-UMT)
**Engineered Safety Systems**
Stability of multilayer earthen barriers used to isolate mill tailings: geologic and geotechnological considerations, 6:33040 (PNL—3902)
**Radiation Monitoring**
Engineering assessment of inactive uranium mill tailings, Shiprock site, Shiprock, New Mexico, 6:33026 (DOE/UMT—0104)
Summary of the engineering assessment of inactive uranium mill tailings, Shiprock Site, Shiprock, New Mexico, 6:33027 (DOE/UMT—0104S)
**Radioactive Waste Disposal**
Biogeochemistry of uranium mill wastes program overview and conclusions, 6:33035 (LA—8861-UMT)
**Radioactive Waste Processing**
Engineering assessment of inactive uranium mill tailings, Shiprock site, Shiprock, New Mexico, 6:33026 (DOE/UMT—0104)
Summary of the engineering assessment of inactive uranium mill tailings, Shiprock Site, Shiprock, New Mexico, 6:33027 (DOE/UMT—0104S)
**Stabilization**
Stability of multilayer earthen barriers used to isolate mill tailings: geologic and geotechnological considerations, 6:33040 (PNL—3902)

**MINE-MOUTH GENERATING PLANTS**
*See COAL MINES*
*FOSSIL-FUEL POWER PLANTS*

**MINERAL RESOURCES**
**Management**
Minerals management at the Department of the Interior needs coordination and organization, 6:33385 (EMD—81-53)

**MINERAL WASTES**
**Waste Disposal**
Solid-waste impacts of increased coal utilization, 6:32865 (BNL—24786)
**MINES**
*See also COAL MINES*
**Seismic Effects**
Damage to underground structures during earthquakes, 6:33925 (DPST—81-262)
**MINING EQUIPMENT**
**Engineering**
Development of a longwall water jet mining machine. Final technical report, 6:32909 (DOE/ET/12542—T1)
**Manufacturers**
Mine demonstrations of longwall dust control techniques. Technical status report, July 31, 1981-August 31, 1981, 6:32908 (DOE/ET/12532—T4)
**Performance Testing**
Development of a longwall water jet mining machine. Final technical report, 6:32909 (DOE/ET/12542—T1)
**MINI-SERVE STATIONS**
*See GASOLINE SERVICE STATIONS*
**MINNESOTA**
**District Heating**
Moorhead district heating. Phase II. Final report, 6:33473 (DOE/CS/20074—1)
**Energy Conservation**
Energy savings from the Minnesota low-income weatherization programme, 6:33397
**Geochemical Surveys**
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
**Geological Surveys**
Inventory of peat resources Koochiching County, Minnesota. Appendix E. Site descriptions, 6:32897 (DOE/ET/14692—T2App.E)
Inventory of peat resources, Koochiching County, Minnesota, 6:32896 (DOE/ET/14692—T2App.A-D)
**Geothermal Resources**
Multi-task support to the Division of Geothermal Energy's hydrothermal resources program. Final report, 6:33206 (DOE/EV/10072—5)
**Peat**
Reconnaissance peatland surveys, 6:32902 (DOE/ET/14692—T1)
**MINORITY GROUPS**
**Fuel Consumption**
Impact of motor-gasoline price/availability trends on selected minority and disadvantaged populations (Atlanta, Georgia; Burlington, Vermont; Greenville, Mississippi; Los Angeles, California; San Antonio, Texas), 6:32980 (DOE/MI/01006—T1-Pt.1)
Impact of motor gasoline price/availability trends on selected minority and disadvantaged populations (Atlanta, Georgia; Burlington, Vermont; Greenville, Mississippi; Los Angeles, California; San Antonio, Texas), 6:32981 (DOE/MI/01006—T1-Pt.2)
**MIRROR FUSION TEST FACILITY**
*See MFTF DEVICES*
**MIRRORS**
*See also HEAT MIRRORS*
**Performance**
Applications of bent cylindrical mirrors to x-ray beamlines, 6:33687 (BNL—29940)
**Specifications**
Applications of bent cylindrical mirrors to x-ray beamlines, 6:33687 (BNL—29940)
**MISSISSIPPI**
**Radiation Monitoring**
Offsite environmental monitoring report. Radiation monitoring around United States nuclear test areas, calendar year 1980, 6:33802 (EPA/600—4-81-047)
**MIXED OXIDE FUELS**
**Chemical Reactions**
High temperature chemomechanical interactions between alkali metals and urania-base oxide reactor fuels, 6:33308 (GEFR-SP—236)
**Fission Products**
Transient redistribution of intragranular fission gas in irradiated mixed oxide, 6:33356 (HEDL-SA—2272)
**Fuel-Cladding Interactions**
Fuel-cladding chemical interaction in uranium-plutonium oxide fast reactor fuel pins, 6:33314
**Radionuclide Migration**
Cesium thermomigration and reaction in nuclear fuels, 6:33313
**MODELS (FLOW)**
*See FLOW MODELS*
**MODELS (PLASMA)**
*See PLASMA SIMULATION*
**MODELS (STAR)**
*See STAR MODELS*
**MOISTURE**
*See also WATER*
**Adsorption**
Effect of network structure on moisture absorption of epoxy resins, 6:33607
**Spatial Distribution**
Measurement of moisture depth distribution in composite materials using positron lifetime technique, 6:33789 (CONF-800433—)
**MOLECULAR BIOLOGY**
**Meetings**
Computer simulation of organic and biological molecules, 6:33846 (LBL—12979)
**Technology Assessment**
Biotechnology in Canada: promises and concerns, 6:33836
**MOLECULAR FLUORESCENCE SPECTROSCOPY**
*See FLUORESCENCE SPECTROSCOPY*
**MOLECULAR ORBITAL MODEL**
*See MOLECULES*
**MOLECULAR STRUCTURE**
**Research Programs**
Materials and Molecular Research Division annual report 1980, 6:33496 (LBL—12000)
**MOLECULES**
**Computerized Simulation**
Computer simulation of organic and biological molecules, 6:33846 (LBL—12979)
**MOLLUSCS**
**Radioactivity**
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)
**Radionuclide Kinetics**
Biokinetic behavior of Tc in the red abalone, Haliotis rufescens: a reassessment (/sup 95m/Tc), 6:33888 (DOE/EV/10251—4)
**MOLTEN CARBONATE FUEL CELLS**
**Uses**
Application of molten carbonate fuel cells to OTEC-generated fuels, 6:33443
**MOLTEN METAL-WATER REACTIONS**
**Heat Transfer**
Propagation of a liquid-liquid explosion, 6:33360 (LA—8971-MS)
**Hydraulics**
Propagation of a liquid-liquid explosion, 6:33360 (LA—8971-MS)
**Hydrodynamics**
Propagation of a liquid-liquid explosion, 6:33360 (LA—8971-MS)
**MOLYBDATES**
**Catalytic Effects**
Exploratory study of coal-conversion chemistry. Quarterly report, December 20, 1979-March 19, 1980, 6:32815 (DOE/ET/14855—6)

**MOLYBDENUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Physical Radiation Effects**
Effect of cyclic pulsed temperature on void growth in metals during irradiation, 6:33522 (LA-UR—81-2437)
**Thermodynamic Properties**
Shock-compression measurements at pressures greater than 1 TPa, 6:33521 (LA-UR—81-2426)
**Voids**
Effect of cyclic pulsed temperature on void growth in metals during irradiation, 6:33522 (LA-UR—81-2437)
**MOLYBDENUM ALLOYS**
*See also MOLYBDENUM BASE ALLOYS*
**Physical Radiation Effects**
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
**Swelling**
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
**MOLYBDENUM BASE ALLOYS**
**Blisters**
Surface radiation damage in molybdenum alloys irradiated, 6:34127 (CONF-801011—(Vol.2))
**MOLYBDENUM COMPLEXES**
**Chemical Reactions**
Comparative reactivities of two isoelectronic transition-metal hydrides with transition-metal carbonyls and alkyls, 6:33594
**MONITORS (REACTOR)**
*See REACTOR CONTROL SYSTEMS*
**MONOCHROMATORS**
**Fabrication**
Polarizing multilayer spectrometer for neutrons, 6:34036 (BNL—29922)
**MONTICELLO REACTOR**
**Fuel Element Clusters**
8 x 8 fuel surveillance program: pre-irradiation characterization, Monticello fuel assembly, December 1974, 6:33291 (DOE/ET/34031—1)
8 x 8 fuel surveillance program at Monticello - end of Cycle 3: first post-irradiation measurements, January 1975, 6:33292 (DOE/ET/34031—2)
8 x 8 fuel surveillance program at Monticello site - end of Cycle 4: second post-irradiation inspection, September 1975, 6:33293 (DOE/ET/34031—3)
8 x 8 fuel surveillance program at Monticello site - end of Cycle 5: third post-irradiation inspection, September 1977, 6:33294 (DOE/ET/34031—4)
8 x 8 fuel surveillance program at Monticello site - end of Cycle 6: fourth post-irradiation inspection, October 1978, 6:33295 (DOE/ET/34031—5)
**MORPHOLOGICAL CHANGES**
**Radioinduction**
How and why of in vitro oncogenic transformation (X-rays: $^{60}$Co), 6:33894
**MORPHOLOGY**
*See MORPHOLOGICAL CHANGES*
**MOSSES**
**Absorption Spectroscopy**
Atmospheric deposition of heavy metals studied by analysis of moss samples using neutron activation analysis and atomic absorption spectrometry, 6:33729 (CONF-800433—)
**Activation Analysis**
Atmospheric deposition of heavy metals studied by analysis of moss samples using neutron activation analysis and atomic absorption spectrometry, 6:33729 (CONF-800433—)
**MS SOLAR CELLS**
**Electrical Properties**
Use of V/sub OC//J/suc SC/ measurements for determination of barrier height under illumination and for fill-factor calculations in Schottky-barrier solar cells, 6:33565
**MULTI-ELEMENT ANALYSIS**
**Accuracy**
Assessments of accuracy and precision of multi-element determinations in whole coal by non-destructive neutron activation analysis, 6:33778 (CONF-800433—)
**MULTIPARTICLE SPECTROMETERS**
**Design**
Multiparticle magnetic spectrometer with dE/dx and TRD particle identification, 6:33669 (BNL—29990)
**MULTIWIRE PROPORTIONAL CHAMBERS**
**Cosmic Ray Detection**
Coordinate measurement by current division: a simple system for multichannel detectors, 6:33691 (SLAC-TN—81-6)
**Design**
Myocardial perfusion scintigraphy using a new technique, the mesh chamber. Progress report, September 1, 1978-May 1, 1981, 6:33689 (DOE/EV/04969—3)
**MUNICIPAL BUILDINGS**
*See PUBLIC BUILDINGS*
**MUNICIPAL WASTES**
*See also REFUSE DERIVED FUELS*
**Energy Recovery**
Potential for resource recovery from municipal solid waste in Warren County, Tennessee, 6:33480 (TVA/OP/EDT—81/39)
**Materials Recovery**
Potential opportunities for revitalization of the Rochester, New York steam district heating system, 6:33479 (ORNL/TM—7757)
**Waste Processing**
Advanced system experimental facility: solid waste to methane gas. Background and process description, 6:33079 (ANL/CNSV—22)
**MUONIC ATOMS**
**Vacuum Polarization**
Non-linear vacuum polarization in strong fields, 6:33974 (LBL—12972)
**MUONS PLUS**
**Depolarization**
Low temperature diffusion of positive muons in copper, 6:33957 (LA-UR—81-2473)
**MUSSELS**
*See MOLLUSCS*
**MUSTARD (NITROGEN)**
*See NITROGEN MUSTARD*
**MUTAGENESIS**
**Comparative Evaluations**
Comparative mutagenesis and interaction between near-ultraviolet (313- to 405-nm) and far-ultraviolet (254-nm) radiation in Escherichia coli strains with differing repair capabilities, 6:33900
**MUTANTS**
**Enzyme Activity**
Molecular mechanisms of pyrimidine dimer excision in Saccharomyces cerevisiae: excision of dimers in cell extracts, 6:33901

**MX DEVICES**
*See MFTF DEVICES*
**MYOCARDIUM**
**Positron Computed Tomography**
Myocardial perfusion scintigraphy using a new technique, the mesh chamber. Progress report, September 1, 1978-May 1, 1981, 6:33689 (DOE/EV/04969—3)

## N

**NAHCOLITE**
**Sorptive Properties**
Evaluation of dry alkalis for removing sulfur dioxide from boiler flue gases. Final report, 6:33270 (EPRI-FP—207)
**NAPHTHALENE**
**Excited States**
New techniques in atomic and molecular laser spectroscopy, 6:33600
**Liquid Column Chromatography**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**NMR Spectra**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**NAPHTHOLS**
**Pyrolysis**
Thermolysis of naphthols, 6:32808 (CONF-810914—6)
**NAPHTHOLS-ALPHA**
*See NAPHTHOLS*
**NAPHTHOLS-BETA**
*See NAPHTHOLS*
**NATIONAL ACCELERATOR LABORATORY**
*See FERMILAB ACCELERATOR*
**NATIONAL ENERGY SECURITY CORPORATION**
*See SYNTHETIC FUELS CORPORATION*
**NATIONAL SYNCHROTRON LIGHT SOURCE**
*See NSLS*
**NATURAL DRAFT COOLING TOWERS**
**Environmental Impacts**
Anomalous snowfall caused by natural-draft cooling towers, 6:33723 (ORNL/TM—7744)
**NATURAL GAS**
**Consumption Rates**
National Interim Energy-Consumption Survey: exploring the variability in energy consumption, 6:33449 (DOE/EIA—0272)
**Enhanced Recovery**
Small-scale experiments with an analysis to evaluate the effect of tailored pulse loading on fracture and permeability. Final report for Phase II, June 11, 1980-June 11, 1981, 6:32992 (DOE/MC/11577—T23)
**Fuel Supplies**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
Workshop proceedings: world oil and natural gas supplies, 6:32982 (EPRI-WS—79-182)
**Meetings**
Workshop proceedings: world oil and natural gas supplies, 6:32982 (EPRI-WS—79-182)
**Technology Assessment**
Technology characterizations: environmental information handbook. Second edition, 6:33840 (DOE/EP—0028)
**NATURAL GAS DEPOSITS**
**Exploration**
Assessment of in-place solution methane in tertiary sandstones: Texas Gulf Coast, 6:32990 (CONF-811026—5)
**Geologic Traps**
Mechanism of the formation of diapiric structural traps in Dongying depression, Shandong, 6:32962
**Interstitial Water**
Salinity of deep formation waters, Texas Gulf Coast - preliminary results, 6:32991 (CONF-811026—6)
**Resource Assessment**
Assessment of in-place solution methane in tertiary sandstones: Texas Gulf Coast, 6:32990 (CONF-811026—5)
Comments on oil and gas reserves in Mexico, 6:33416 (EPRI-WS—79-182)
**NATURAL LIGHTING**
*See DAYLIGHTING*
**NEAR ULTRAVIOLET RADIATION**
*(Wavelength range 4000-2000 A.)*
**Carcinogenesis**
Experimental radiation carcinogenesis: what have we learned ($^{60}$Co; fission neutrons; mice), 6:33895
**Mutagenesis**
Comparative mutagenesis and interaction between near-ultraviolet (313- to 405-nm) and far-ultraviolet (254-nm) radiation in Escherichia coli strains with differing repair capabilities, 6:33900
**NEBRASKA**
**Geochemical Surveys**
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
**NEODYMIUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**NEODYMIUM COMPOUNDS**
**Hydrolysis**
Nuclear waste management, 6:33589 (LBL—12000)
**NEODYMIUM LASERS**
**Focusing**
Aberrations and focusability in large solid-state-laser systems, 6:34186 (UCRL—85645)
**NEODYMIUM SILICATES**
**Hexagonal Lattices**
Crystal structure and stoichiometry of the Ca/sub 2+x/Nd/sub 8-x/($SiO_4$)$_6$O/sub 2-1/2x/ system, 6:33591 (PNL-SA—9377)
**Stoichiometry**
Crystal structure and stoichiometry of the Ca/sub 2+x/Nd/sub 8-x/($SiO_4$)$_6$O/sub 2-1/2x/ system, 6:33591 (PNL-SA—9377)
**NEON 20 REACTIONS**
**Deep Inelastic Heavy Ion Reactions**
Classical-equations-of-motion calculations of multiplicities for high-energy collisions of $^{20}$Ne + $^{20}$Ne, 6:34012
**Knock-Out Reactions**
Two-proton correlation measurements in 800 and 400 MeV/nucleon heavy-ion reactions, 6:34008
**NEON 20 TARGET**
**Neon 20 Reactions**
Classical-equations-of-motion calculations of multiplicities for high-energy collisions of $^{20}$Ne + $^{20}$Ne, 6:34012
**NEOPLASMS**
*See also CARCINOMAS*
**Biological Radiation Effects**
Abstracts of twenty-ninth annual meeting of the Radiation Research Society, Minneapolis, Minnesota, 31 May-4 June 1981 (Lead abstract), 6:33897
**Diagnosis**
Neutron activation analysis of hair from breast cancer patients, 6:33867 (CONF-800433—)
**Radioinduction**
Experimental radiation carcinogenesis: what have we learned ($^{60}$Co; fission neutrons; mice), 6:33895
Influence of noncarcinogenic secondary factors on radiation carcinogenesis (In vitro; hamsters; x ray), 6:33896
**NEPTUNIUM**
**Superconductivity**
Hill plots and americium, 6:34048

**NERVOUS SYSTEM**
**Biological Radiation Effects**
Abstracts of twenty-ninth annual meeting of the Radiation Research Society, Minneapolis, Minnesota, 31 May-4 June 1981 (Lead abstract), 6:33897
**NETWORKS (COMPUTER)**
*See COMPUTER NETWORKS*
**NEUTRAL BEAM SOURCES**
*See also ION SOURCES*
**Grids**
Thermal and structural analyses of a long pulse multiaperture grid for a neutral beam injector, 6:34083 (CONF-801011—(Vol.1))
**Materials Testing**
Materials application in neutral beam injectors and RF heating systems, 6:34137 (CONF-801011—(Vol.2))
**NEUTRINO-NEUTRON INTERACTIONS**
**Particle Production**
Study of the reaction $\nu n \rightarrow \nu p \pi^-$, 6:33973
**NEUTRINOS**
**Mass**
Neutrino masses: theory and experiment, 6:33977
**NEUTRON ACTIVATION ANALYZERS**
**Accuracy**
Neutron activation analysis of copper and silver in environmental samples, 6:33736 (CONF-800433—)
**Uses**
Application of neutron activation analysis in a regulatory agency, 6:33883 (CONF-800433—)
**NEUTRON BEAMS**
**Monochromators**
Polarizing multilayer spectrometer for neutrons, 6:34036 (BNL—29922)
**Spin Orientation**
Polarizing multilayer spectrometer for neutrons, 6:34036 (BNL—29922)
**NEUTRON CAPTURE**
*See NEUTRON BEAMS*
**NEUTRON DETECTION**
**Plastic Scintillation Detectors**
Contribution of carbon interactions to the neutron counting efficiency of organic scintillators, 6:33695
**Streak Photography**
Design of neutron streak camera for fusion diagnostics, 6:34072 (UCRL—86162)
**NEUTRON DETECTORS**
**Evaluation**
Application of the active well coincidence counter (AWCC) to high-enrichment uranium metal, 6:33060 (LA—8621-MS)
**NEUTRON REACTIONS**
**Capture**
Neutron capture cross section standards for BNL 325, Fourth Edition, 6:34039 (BNL-NCS—51388)
PAPIN: A Fortran-IV program to calculate cross section probability tables, Bondarenko and transmission self-shielding factors for fertile isotopes in the unresolved resonance region, 6:34028 (ORNL/TM—7883)
**Cross Sections**
Neutron capture cross section standards for BNL 325, Fourth Edition, 6:34039 (BNL-NCS—51388)
Neutron cross section measurements using the ORELA: the stable tellurium isotopes (n,$\gamma$), $^{238}$U(n,n'), $^{232}$Th(n,n'), $^{187}$Os(n,n'), $^{186\ 187\ 188}$Os(n,nn'$\gamma$), and $^{205}$Tl(n,n$\gamma$). Progress report, September 1, 1980-September 1, 1981, 6:33991 (DOE/ER/02696—11)
Ni elemental neutron induced reaction cross-section evaluation, 6:34038 (BNL-NCS—51346)
**Scattering Lengths**
Experimental determination of anomalous scattering lengths of samarium for thermal neutrons, 6:34018 (BNL—29949)
**Standards**
Neutron capture cross section standards for BNL 325, Fourth Edition, 6:34039 (BNL-NCS—51388)
**Total Cross Sections**
PAPIN: A Fortran-IV program to calculate cross section probability tables, Bondarenko and transmission self-shielding factors for fertile isotopes in the unresolved resonance region, 6:34028 (ORNL/TM—7883)
**NEUTRON SOURCE FACILITIES**
Instrumented in-reactor test capabilities in FFTF, 6:34174 (HEDL-SA—2476-FP)
**Neutron Emission**
Neutron environment in d + Li facilities, 6:34173 (HEDL-SA—2340FP)
**NEUTRON SOURCES**
*(Excludes reactors even when used as neutron sources.)*
Feasibility of using a novel pulsed neutron source for in vivo: prompt gamma analysis, 6:33866 (CONF-800433—)
**Electrical Insulators**
Aging of Adiprene L-100/butanediol/trimethylolpropane stocks, 6:33069 (GEPP-TIS—587)
**NEUTRON STARS**
**Collisions**
One dimensional hydrodynamics of asteroid-neutron star collisions, 6:33948
**Cosmic Gamma Sources**
One dimensional hydrodynamics of asteroid-neutron star collisions, 6:33948
**NEUTRON-GAMMA LOGGING**
**Calibration**
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
**NEVADA**
**Geochemical Surveys**
Hawthorne study area, 6:33215 (DOE/NV/10039—3)
Paradise Valley study area, 6:33216 (DOE/NV/10039—3)
Southern Carson Sink study area, 6:33217 (DOE/NV/10039—3)
**Geological Surveys**
Hawthorne study area, 6:33215 (DOE/NV/10039—3)
Southern Carson Sink study area, 6:33217 (DOE/NV/10039—3)
**Geophysical Surveys**
Hawthorne study area, 6:33215 (DOE/NV/10039—3)
Paradise Valley study area, 6:33216 (DOE/NV/10039—3)
Southern Carson Sink study area, 6:33217 (DOE/NV/10039—3)
**Geothermal Exploration**
Low-to-moderate temperature geothermal resource assessment for Nevada, area specific studies. Final report, June 1, 1980-August 30, 1981, 6:33207 (DOE/NV/10039—3)
**Geothermal Resources**
Low-to-moderate temperature geothermal resource assessment for Nevada, area specific studies. Final report, June 1, 1980-August 30, 1981, 6:33207 (DOE/NV/10039—3)
Statewide geothermal resource assessment, 6:33208 (DOE/NV/;0039—3)
**NEVADA TEST SITE**
**Nuclear Explosions**
Results of calculations of external gamma-radiation exposure rates from fallout and the related radionuclide compositions. Operation Ranger, 1951, 6:33805 (UCRL—53152-Pt.1)
**Radiation Monitoring**
Offsite environmental monitoring report. Radiation monitoring around United States nuclear test areas, calendar year 1980, 6:33802 (EPA/600—4-81-047)
**NEW YORK**
**District Heating**
Potential opportunities for revitalization of the Rochester, New York steam district heating system, 6:33479 (ORNL/TM—7757)
**Dual-Purpose Power Plants**
Potential opportunities for revitalization of the Rochester, New York steam district heating system, 6:33479 (ORNL/TM—7757)
**Resource Recovery Facilities**
Potential opportunities for revitalization of the Rochester, New York steam district heating system, 6:33479 (ORNL/TM—7757)

**NICKEL**
**Chemical Radiation Effects**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Corrosion**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Creep**
Pulsed-irradiation creep in nickel, 6:33530 (PNL-SA—9266)
Stress dependence of creep in Ni bombarded with 17-MeV deuterons, 6:33532 (PNL-SA—9728)
**Embrittlement**
Relative effects of S, Sb and P on the intergranular fracture of iron and nickel tested at cathodic potentials, 6:33531 (PNL-SA—9446)
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Physical Radiation Effects**
Pulsed-irradiation creep in nickel, 6:33530 (PNL-SA—9266)
Stress dependence of creep in Ni bombarded with 17-MeV deuterons, 6:33532 (PNL-SA—9728)
**Sorptive Properties**
Processes and techniques, 6:32839 (LBL—12000)
**NICKEL 60 TARGET**
**Lithium 6 Reactions**
Elastic and inelastic scattering of 88 MeV $^{6}$Li ions, 6:34013
**NICKEL ALLOYS**
*See also CHROMIUM-NICKEL STEELS*
*NICKEL BASE ALLOYS*
**Amorphous State**
Structural relaxation rates in amorphous Metglas alloys $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_{80}B_{80}$, 6:33523 (LA-UR—81-2444)
**Corrosion**
Effect of mechanical cleaning on seawater corrosion of candidate OTEC heat exchanger materials. Part 2. Tests with Amertap sponge rubber balls, 6:33149 (ANL/OTEC-BCM—018)
**Diffusion**
Zero-flux planes and flux reversals in multicomponent diffusion. Progress report, January 1, 1981-August 31, 1981 (Cu-Ni-Zn; Fe-Ni-Cr), 6:33508 (DOE/ER/10814—1)
**Electric Conductivity**
Effect of applied stress on the transformation behavior of Ni-Ti, 6:33518 (IS-M—338)
Structural relaxation rates in amorphous Metglas alloys $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_{80}B_{80}$, 6:33523 (LA-UR—81-2444)
**Mechanical Structures**
Magnetic fusion energy, 6:33526 (LBL—12000)
**Microstructure**
Magnetic fusion energy, 6:33526 (LBL—12000)
**Phase Studies**
Effect of applied stress on the transformation behavior of Ni-Ti, 6:33518 (IS-M—338)
**Pitting Corrosion**
Investigation of high temperature corrosion of Ni-Cr alloy by the burning hydrocarbons, 6:33662
**Stresses**
Effect of applied stress on the transformation behavior of Ni-Ti, 6:33518 (IS-M—338)
**Sulfidation**
Corrosion data for uncooled alloys in the bed of an atmospheric fluidized-bed boiler, 6:33661
**NICKEL BASE ALLOYS**
*See also INCONEL ALLOYS*
**Hydridation**
Hydride chemical compressor. Phase I, final report, 6:33631 (BNL—51369)
**NICKEL ISOTOPES**
**Neutron Reactions**
Ni elemental neutron induced reaction cross-section evaluation, 6:34038 (BNL-NCS—51346)
**NICKEL-ZINC BATTERIES**
**Electrodes**
Investigation of the zinc electrode reaction. Annual report, October 1, 1979-September 30, 1980, 6:33377 (BNL—51370)
**NIOBIUM**
**Chemical Radiation Effects**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Corrosion**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Deformation**
Slip systems and solid solution softening/hardening in BCC metals (Low-temperature deformation), 6:33504 (CONF-810391—1)
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Physical Radiation Effects**
Similar dependence on dilute O concentration of void formation in ion-irradiated Nb and some properties of unirradiated Nb, 6:33539
**Yield Strength**
Similar dependence on dilute O concentration of void formation in ion-irradiated Nb and some properties of unirradiated Nb, 6:33539
**NIOBIUM ALLOYS**
*See also NIOBIUM BASE ALLOYS*
**Blisters**
Surface radiation damage in molybdenum alloys irradiated, 6:34127 (CONF-801011—(Vol.2))
**Chemical Radiation Effects**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Corrosion**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Deformation**
Effects of tensile deformation on the strain memory behavior of uranium-niobium $\alpha''$ martensite, 6:33534 (Y/DV—134)
**Physical Radiation Effects**
Imaging of small distortions in A15 'lattice' by electron microscopy (Neutron irradiation), 6:33528
**Specific Heat**
Superconductivity in Th-Nb composites, 6:33520 (IS-T—926)

**Superconductivity**
Superconducting properties of $(Nb,Ti)_3Sn$ wires fabricated by the bronze process, 6:33502 (BNL—30019)
Superconductivity in Th-Nb composites, 6:33520 (IS-T—926)
**Tensile Properties**
Effects of tensile deformation on the strain memory behavior of uranium-niobium $\alpha''$ martensite, 6:33534 (Y/DV—134)
**Transition Temperature**
Superconductivity in Th-Nb composites, 6:33520 (IS-T—926)

**NIOBIUM BASE ALLOYS**
**Extrusion**
Comparison of hydrostatic extrusion versus wire drawing as a method of producing $Nb_3Sn$ superconducting wire, 6:33499 (BNL—29941)
**Physical Radiation Effects**
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
**Superconductivity**
Superconducting current densities in bronze-processed $Nb_3Sn$ multifilamentary wires, 6:33501 (BNL—30018)
**Swelling**
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)

**NIOBIUM OXIDES**
**Crack Propagation**
In-situ electron microscope fracture studies of amorphous films, 6:33545 (CONF-810851—2)

**NITRATES**
**Biological Effects**
Evaluation of CHESS: New York asthma data 1971 to 1972. Volume 2, 6:33910 (EPRI-EA—1994(Vol.2))

**NITRIC OXIDE**
**Chemical Reaction Yield**
Fundamentals of nitric oxide formation in fossil-fuel combustion. Progress report, 29 September-28 December 1980, 6:32944 (DOE/ET/10593—T2)

**NITRITES**
*See NITROUS ACID*
**Chemical Reaction Kinetics**
Aqueous reactions of nitrite and bisulfite, 6:33749 (LBL—11986)

**NITROBENZENE**
**Raman Spectra**
New techniques in atomic and molecular laser spectroscopy, 6:33600

**NITROGEN**
**Activation Analysis**
Determination of low-Z elements simultaneously by $^3$HE-induced nuclear wastes, 6:33580 (LBL—11986)
Studies of Oxygen and Nitrogen in coal conversion liquids by 14 MeV INAA, 6:33816 (CONF-800433—)
**Removal**
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, October-December 1979, 6:32813 (DOE/ET/14700—1)
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1980, 6:32814 (DOE/ET/14700—2)
**Thermal Analysis**
Determination of low-Z elements simultaneously by $^3$HE-induced nuclear wastes, 6:33580 (LBL—11986)

**NITROGEN 14**
**Hypernuclei**
Experimental study of the sigma-nucleon system through the reaction d(K,$\pi$)SIGMA N. Progress report, January 1, 1981-December 31, 1981, 6:33967 (DOE/ER/04195—5)

**NITROGEN 14 TARGET**
**Electron Reactions**
Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)

**NITROGEN 15 REACTIONS**
**Spontaneous Fission**
Search for an 80 ms spontaneous fission activity in bombardments of $^{249}$Bk with $^{15}$N, 6:34031

**NITROGEN 15 TARGET**
**Electron Reactions**
Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)

**NITROGEN MUSTARD**
**Cell Killing**
Third-chromosome mutagen-sensitive mutants of Drosophila melanogaster, 6:33861

**NITROGEN OXIDES**
*See also NITRIC OXIDE*
**Air Pollution Abatement**
Evaluation of concepts for controlling exhaust emissions from minimally processed petroleum and synthetic fuels, 6:32953
Low NO/sub x/ combustion systems for burning heavy residual fuels and high-fuel-bound nitrogen fuels, 6:32951
Tennessee Valley Authority atmospheric fluidized-bed combustor simulation interim annual report, January 1-December 31, 1980, 6:33265 (ORNL/TM—7847)
**Air Pollution Control**
Design and preliminary results of a fuel flexible industrial gas turbine combustor, 6:32950
Economics and control technology for NOx and particulate emissions from coal-fired power plants, 6:33272
Soot formation in synthetic fuel droplets. Third quarterly technical progress report, April 1 to June 30, 1981, 6:33743 (DOE/PC/30298—T3)
**Chemical Reaction Yield**
Kinetics of NO/sub x/ formation during early stages of pulversized-coal combustion. Third quarterly report, 4 April 1981-30 June 1981, 6:32945 (DOE/PC/30295—3)
**Chemical Reactions**
Reactions of nitrogen oxides, ozone and sulfur in power plant plumes, 6:33744 (EPRI-EA—270)
**Monitoring**
MAP3S/RAINE emissions inventory. Progress report, December 1980, 6:33725 (BNL—51378)
**Oxidation**
Activated carbon catalyzed oxidation of aqueous S(IV) species, 6:33747 (LBL—11986)
**Reduction**
Kinetics of reactions in a wet flue-gas simultaneous desulfurization and denitrification system, 6:32878 (LBL—13063)

**NITROMETHANE**
**Underwater Explosions**
Detonation-product behavior at large expansion: the underwater detonation of nitromethane, 6:33714 (UCRL—52903)

**NITROUS ACID**
**Environmental Impacts**
Importance of soot particles and nitrous acid oxidizing $SO_2$ in atmospheric aqueous droplets, 6:33750 (LBL—11986)

**NMR LOGGING**
*See NUCLEAR MAGNETIC LOGGING*

**NMR SPECTROMETERS**
**Performance**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)

**NOBELIUM**
**Chemical Properties**
Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:33624
**Chemistry**
Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:33624

**NOISE POLLUTION**
**Environmental Impacts**
Noise, 6:33916 (DOE/EP/10012—1)

**NORTH CAROLINA**
**Geological Surveys**
Peat deposits of Dismal Swamp pocosins: Camden, Currituck, Gates, Pasquotank, and Perquimans Counties, North Carolina, 6:32898 (DOE/ET/14693—T3)

**NORTH DAKOTA**
**Biomass**
Wood resources and utilization patterns in the North Central Region and energy needs for the manufacture of wood products, 6:33114 (MASEC/R—81-005)
**NORTHERN IRELAND**
*See UNITED KINGDOM*
**NORTHERN STATES MONTICELLO REACTOR**
*See MONTICELLO REACTOR*
**NORWAY**
**Coastal Regions**
Estimation of time series models for horizontal wind on the Norwegian west coast, 6:33235
**Regional Analysis**
Atmospheric deposition of heavy metals studied by analysis of moss samples using neutron activation analysis and atomic absorption spectrometry, 6:33729 (CONF-800433—)
**NOVA FACILITY**
**Optical Systems**
Aberrations and focusability in large solid-state-laser systems, 6:34186 (UCRL—85645)
**NOVAE**
**Star Models**
Hydrodynamic studies of the nova outburst, 6:33950
**NSLS**
**Uses**
Use of a synchrotron radiation x-ray microprobe for elemental analysis at the national synchrotron light source, 6:33790 (CONF-800433—)
**NUCLEAR CHEMISTRY**
**Public Health**
Chemist in the clinic, 6:33882 (CONF-800433—)
**NUCLEAR DATA COLLECTIONS**
**Benchmarks**
ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)
**Data Base Management**
Minutes of the fifth annual meeting of the panel on reference nuclear data, 6:34201 (BNL-NCS—51364)
**NUCLEAR EXPLOSIONS**
*See also UNDERGROUND EXPLOSIONS*
**Containment**
Engineering evaluation of Riola containment, 6:33719 (UCID—19164)
**Engineering**
Engineering evaluation of Riola containment, 6:33719 (UCID—19164)
**NUCLEAR EXPLOSIVES**
**Design**
Improvements in explosive charges (French patent), 6:33718 (LA-tr—81-23)
**Fabrication**
Improvements in explosive charges (French patent), 6:33718 (LA-tr—81-23)
**NUCLEAR FACILITIES**
*See also ANTARES FACILITY*
*FUEL REPROCESSING PLANTS*
**Decommissioning**
Proposed draft standard ANS 11.18: recommendations to facilitate decontamination and decommissioning, 6:33638 (PNL-SA—9635)
Radiological planning guide for DOE decommissioning operations, 6:33057 (PNL-SA—9262)
**Decontamination**
Proposed draft standard ANS 11.18: recommendations to facilitate decontamination and decommissioning, 6:33638 (PNL-SA—9635)
**NUCLEAR FUELS**
*See also ALLOY NUCLEAR FUELS*
*FUEL SLURRIES*
*FUEL SOLUTIONS*
**Activation Analysis**
Instrumental prompt gamma activation analysis of energy-related samples and standards, 6:33777 (CONF-800433—)
**Meetings**
Atomic Industrial Forum Inc., fuel cycle conference, 1980, 6:33019
**Multi-Element Analysis**
Instrumental prompt gamma activation analysis of energy-related samples and standards, 6:33777 (CONF-800433—)
Prompt neutron capture gamma ray analysis of nuclear fuel materials with a pair spectrometer, 6:33788 (CONF-800433—)
**NUCLEAR INDUSTRY**
**Occupational Safety**
Management Oversight and Risk Tree - MORT, 6:33918 (DOE/ID/01375—T1)
**Political Aspects**
Some political issues related to future special nuclear materials production, 6:33061 (LA—8969-MS)
**NUCLEAR MAGNETIC LOGGING**
**Magnetic Fields**
Magnetic resonance apparatus (Patent), 6:33707
**NUCLEAR MATERIALS DIVERSION**
**Detection**
Evaluation of active and passive near-millimeter-wave radiometric imaging techniques for detection of concealed objects, 6:33062 (SAND—81-1051)
**NUCLEAR MATERIALS MANAGEMENT**
**Accounting**
Gamma-ray spectrometric determination of $UF_6$ assay with 1 percent precision for international safeguards. Part 1. Product and feed in 1S and 2S sample cylinders, 6:33576 (K/OA—5014-Rev.1)
**Emission Spectroscopy**
Application of ICP-AES to the multi-elemental and multi-isotopic analysis of fuel dissolver solutions. Progress report, 6:33059 (IS-M—337)
**NUCLEAR MATTER**
**Correlations**
Calculation of correlation functions in nuclear matter, 6:34032
**Density**
Finite region density increase effects in the Lee-Wick model, 6:34034
**Scalar Fields**
Finite region density increase effects in the Lee-Wick model, 6:34034
**NUCLEAR PARKS**
**Environmental Impacts**
Nuclear energy center conceptual study. Phase III: site specific evaluation. Topical report, environmental, 6:33335 (DOE/OR/06074—1-Vol.3)
**Socio-Economic Factors**
Nuclear energy center conceptual study. Phase III: site specific evaluation. Topical report, environmental, 6:33335 (DOE/OR/06074—1-Vol.3)
**NUCLEAR PHYSICS**
**Forecasting**
Summary of the proceedings of the workshop on future directions in nuclear physics research, 6:33993 (DOE/ER/10472—1)
**Research Programs**
Nuclear structure study at intermediate energies. Annual progress report, November 1980-July 1981, 6:33992 (DOE/ER/04215—5)
Summary of the proceedings of the workshop on future directions in nuclear physics research, 6:33993 (DOE/ER/10472—1)
**NUCLEAR POWER**
**Environmental Impacts**
Findings supporting determination related to international nuclear power export activities pending preparation of a section 102(2)(C) NEPA environmental statement, 6:33290 (ERDA—80)
**Exports**
Findings supporting determination related to international nuclear power export activities pending preparation of a section 102(2)(C) NEPA environmental statement, 6:33290 (ERDA—80)
**Safeguards**
Findings supporting determination related to international nuclear power export activities pending preparation of a section 102(2)(C) NEPA environmental statement, 6:33290 (ERDA—80)

**Technology Assessment**
Technology characterizations: environmental information handbook. Second edition, 6:33840 (DOE/EP—0028)
**NUCLEAR POWER PLANTS**
*See also UNDERGROUND NUCLEAR STATIONS*
Evaluating R and D options under uncertainty. Volume 3. An electric-utility generation-expansion planning model. Final report, 6:33426 (EPRI-EA—1964(Vol.3))
**Control Rooms**
Evaluation of proposed control room improvements through analysis of critical operator decisions. Final report, 6:33333 (EPRI-NP—1982)
Janus displays for improved reactor plant operation and control, 6:33331 (CONF-810606—71)
**Emergency Plans**
Application of MORT analysis to emergency preparedness for nuclear power stations (Management Oversight and Risk Tree approach), 6:33362 (PNL-SA—9316)
**Ionization Chambers**
Optimal calibration of nuclear instrumentation, 6:33332 (CONF-810606—72)
**Performance**
Potential contribution of currently operating nuclear-fueled electric-generating units to reducing US oil consumption, 6:33392 (ORNL/Sub—80/40416/1)
**Public Opinion**
Public perceptions of industrial risks: the context of public attitudes toward radioactive waste, 6:33382 (PNL—3799)
**Reactor Control Systems**
Janus displays for improved reactor plant operation and control, 6:33331 (CONF-810606—71)
**Reactor Instrumentation**
Optimal calibration of nuclear instrumentation, 6:33332 (CONF-810606—72)
**Reactor Materials**
Structural Mechanics Program: progress in 1980, 6:33289 (EPRI-NP—1969-SR)
**Safeguards**
NASAP and INFCE: the final reports, 6:33321
**NUCLEAR REACTION ANALYSIS**
*(Chemical analysis based on detection and analysis of prompt nuclear reaction products, e.g., gamma rays, neutrons, or charged particles.)*
**Meetings**
Nuclear methods in environmental and energy research, 6:33784 (CONF-800433—)
**NUCLEAR REACTION KINETICS**
**Computer Codes**
Description and use of the Monte Carlo code LILITA (Modeling of equilibrium decay of heavy ion reaction products), 6:34019 (ORNL/TM—7295)
**NUCLEAR REACTIONS**
*See also BREAKUP REACTIONS*
*CHARGED-PARTICLE REACTIONS*
*COMPOUND-NUCLEUS REACTIONS*
*FISSION*
*FUSION REACTIONS*
*PHOTONUCLEAR REACTIONS*
*THERMONUCLEAR REACTIONS*
**Cross Sections**
Role of the attractive nuclear potential in determining reaction cross sections, 6:34033
**NUCLEAR WASTES**
*See RADIOACTIVE WASTES*
**NUCLEAR WEAPON TESTS**
*See NUCLEAR EXPLOSIONS*
**NUCLEAR WEAPONS**
**Blast Effects**
Blast/fire interactions. Proceedings of conference held in Asilomar, California, May 18-21, 1980, 6:33717 (FEMA—2563F)
**NUCLEOTIDES**
**Molecular Structure**
Computer simulation of organic and biological molecules, 6:33846 (LBL—12979)

## O

**OAK RIDGE GASEOUS DIFFUSION PLANT**
*See ORGDP*
**OAK RIDGE NATIONAL LABORATORY**
*See ORNL*
**OCCUPATIONAL DISEASES**
**Epidemiology**
Epidemiological approaches to reproductive hazards of the workplace, 6:33913 (PNL-SA—9435)
**Risk Assessment**
Problems in evaluating health effects of occupational and environmental exposures, 6:33891 (PNL-SA—9632)
**OCCUPATIONAL SAFETY**
**Implementation**
Guidance for implementing an Environmental, Safety, and Health Assurance Program. Volume I. A model plan for Institutional Environmental, Safety, and Health Assurance Programs, 6:33920 (SAND—81-0632)
**Management**
Guidance for implementing an environmental, safety and health assurance program. Volume 14. Model guidelines for utilizing quality assurance support in environmental, safety and health assurance programs (Guidance for quality assurance programs), 6:33921 (SAND—81-0645)
Management Oversight and Risk Tree - MORT, 6:33918 (DOE/ID/01375—T1)
**Risk Assessment**
Management Oversight and Risk Tree - MORT, 6:33918 (DOE/ID/01375—T1)
**OCEAN THERMAL ENERGY CONVERSION**
**Commercialization**
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)
**Engineering**
OTEC support services. Quarterly technical progress report No. 13, 15 May 1981-14 August 1981, 6:33151 (DOE/ET/21002—T19)
**Environmental Impacts**
Environmental programs for ocean thermal energy conversion (OTEC), 6:33154 (LBL—12977)
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)
Ocean thermal energy conversion programmatic environmental analysis, 6:33152 (LBL—10511-Vol.1)
**Hazards**
Ocean thermal energy conversion programmatic environmental analysis, 6:33152 (LBL—10511-Vol.1)
**Legal Aspects**
Ocean thermal energy conversion programmatic environmental analysis, 6:33152 (LBL—10511-Vol.1)
**Open-Cycle Systems**
Overview and FY 1981 progress on open-cycle OTEC power systems, 6:33157 (SERI/TP—634-1282)
**Program Management**
OTEC support services. Quarterly technical progress report No. 13, 15 May 1981-14 August 1981, 6:33151 (DOE/ET/21002—T19)
**Resource Assessment**
Geographic distribution of the OTEC resource off the south and east coasts of the Florida Peninsula, 6:33150 (DOE/ER/05518—1)
**OCEAN THERMAL POWER PLANTS**
**Energy Transport**
Application of molten carbonate fuel cells to OTEC-generated fuels, 6:33443
**Fluid Mechanics**
Research on the external fluid mechanics of ocean thermal energy conversion plants. Report covering experiments in stagnant water, 6:33155 (MIT-EL—79-041)
**Plumes**
Research on the external fluid mechanics of ocean thermal energy conversion plants. Report covering experiments in stagnant water, 6:33155 (MIT-EL—79-041)

**OCTANE**
**Liquid Column Chromatography**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**NMR Spectra**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**OFFSHORE DRILLING**
**Feasibility Studies**
Engineering for deep sea drilling for scientific purposes. Final report, 6:33664 (AD-A—092605)
**Recommendations**
Engineering for deep sea drilling for scientific purposes. Final report, 6:33664 (AD-A—092605)
**Technology Transfer**
Engineering for deep sea drilling for scientific purposes. Final report, 6:33664 (AD-A—092605)
**OFFSHORE PLATFORMS**
**Construction**
Cost control for offshore structures, 6:33665
**OIL BURNERS**
**Flue Gas**
Particulate emission characteristics of oil-fired urtility boilers, 6:32989 (EPRI-CS—1995)
**OIL FIELDS**
**Well Spacing**
Rational rate of recovery and well density in the development of carbonate pools in Renqiu, 6:32973
**OIL SAND INDUSTRY**
**Economic Impact**
Environmental, health, safety, and socioeconomic impacts associated with oil recovery from tar-sand deposits in the United States, 6:32998 (UCRL—53197)
**Environmental Impacts**
Environmental, health, safety, and socioeconomic impacts associated with oil recovery from tar-sand deposits in the United States, 6:32998 (UCRL—53197)
**Pollution Regulations**
Environmental, health, safety, and socioeconomic impacts associated with oil recovery from tar-sand deposits in the United States, 6:32998 (UCRL—53197)
**Social Impact**
Environmental, health, safety, and socioeconomic impacts associated with oil recovery from tar-sand deposits in the United States, 6:32998 (UCRL—53197)
**OIL SANDS**
**Resource Development**
Environmental, health, safety, and socioeconomic impacts associated with oil recovery from tar-sand deposits in the United States, 6:32998 (UCRL—53197)
**OIL SHALE INDUSTRY**
**Environmental Impacts**
Effects of oil-shale solid-waste disposal on water quality: current knowledge, information requirements, and research strategy, 6:32997 (PNL-SA—9792)
**OIL SHALE PROCESSING PLANTS**
**Materials Testing**
Fossil energy, 6:32862 (LBL—12000)
**OIL SHALES**
*See also BLACK SHALES*
**In-Situ Retorting**
Failure surface model for oil shale, 6:32993 (SAND—81-1128)
Lawrence Livermore National Laboratory Oil-Shale Project. Quarterly report, April-June 1981, 6:32994 (UCID—16986-81-2)
**Retorting**
Lawrence Livermore National Laboratory Oil-Shale Project. Quarterly report, April-June 1981, 6:32994 (UCID—16986-81-2)
**OIL WELLS**
*See also PETROLEUM*
**In-Situ Combustion**
Bodcau in situ combustion project. Fourth annual report, September 1, 1979-February 28, 1981, 6:32969 (DOE/ET/12057—8)
**Steam Injection**
Project DEEP STEAM: fourth meeting of the technical advisory panel, Albuquerque, NM, November 1980, 6:32971 (SAND—81-0043)
**Testing**
Study of the unsteady-state flow of slightly compressible fluid in naturally fractured reservoirs and its application in well test analysis, 6:32974
**Waterflooding**
Field pilot test to demonstrate the whole process of water flooding in the Daqing oil field, 6:32972
**OIL-EXPORTING COUNTRIES**
**Taxes**
Rent-skimmers, techniques for risk minimization, and impact on incentives, 6:33409 (EPRI-WS—79-182)
**OIL-IMPORTING COUNTRIES**
**Taxes**
Rent-skimmers, techniques for risk minimization, and impact on incentives, 6:33409 (EPRI-WS—79-182)
**OLIGONUCLEOTIDES**
*See NUCLEOTIDES*
**ONCOGENIC TRANSFORMATIONS**
**Radioinduction**
How and why of in vitro oncogenic transformation (X-rays: $^{60}$Co), 6:33894
Influence of noncarcinogenic secondary factors on radiation carcinogenesis (In vitro; hamsters; x ray), 6:33896
**ONCOGENIC VIRUSES**
**Molecular Biology**
Chromatographic evidence that the AAA-coding isoacceptor of lysine tRNA primes DNA synthesis in murine mammary tumor virus, 6:33875
**ON-LINE CONTROL SYSTEMS**
**Programming**
Some notes on operating-system principles, 6:34196 (UCID—19076)
**ON-SITE POWER GENERATION**
**Acid Electrolyte Fuel Cells**
Cell-module & fuel-conditioner development. 6th quarterly report, January-March 1981, 6:33439 (DOE/NASA/0161—7)
**OPTICAL MICROSCOPY**
**Prisms**
Optical device with conical input and output prism faces (Patent), 6:33705
**ORBITAL SOLAR POWER PLANTS**
**Microwave Power Transmission**
Solar power satellite microwave transmission and reception, 6:33133 (NASA-CP—2141)
**ORELA**
*(Oak Ridge electron linear accelerator.)*
**Electron Guns**
ORELA electron guns, 6:33672 (ORNL/TM—7886)
**ORGANIC ACIDS**
*(Excluding NUCLEIC ACIDS and NUCLEOTIDES.)*
**Liquid Column Chromatography**
Liquid-liquid chromatography fractionation of organic compounds in complex mixtures: application to automobile exhaust, 6:33575 (IS-T—914)
**ORGANIC COMPOUNDS**
*See also ALDEHYDES*
*AMINES*
*HYDROCARBONS*
*HYDROXY COMPOUNDS*
*KETONES*
*LIPIDS*
*NUCLEOTIDES*
*ORGANIC ACIDS*
*ORGANIC HALOGEN COMPOUNDS*
*ORGANOMETALLIC COMPOUNDS*
*PROTEINS*
*TERPENES*
**Environmental Transport**
Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)
**Geochemistry**
Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)

**Molecular Biology**
Computer simulation of organic and biological molecules, 6:33846 (LBL—12979)
**ORGANIC HALOGEN COMPOUNDS**
**Activation Analysis**
Neutron activation for the determination of total halogenated organics, 6:33785 (CONF-800433—)
**ORGANIC SOLVENTS**
**Chemical Properties**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**Recycling**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**ORGANOMETALLIC COMPOUNDS**
**Chromatography**
Organically bound metals in a solvent-refined coal: metallograms for a Wyoming subbituminous coal, 6:32843
**Natural Occurrence**
Organically bound metals in a solvent-refined coal: metallograms for a Wyoming subbituminous coal, 6:32843
**ORGDP**
*(Oak Ridge Gaseous Diffusion Plant.)*
**Noise**
Measurement of outdoor noise levels adjacent to K-25 facility, ORGDP, 6:33046 (K/SUB—13876-81/1)
**ORNL**
*(Oak Ridge National Laboratory.)*
**Hot Labs**
Current status of the transuranium processing plant, 6:33625
**OSMIUM COMPLEXES**
**Catalytic Effects**
Mechanistic studies of carbon monoxide reduction. Progress report, August 1, 1980-August 1, 1981, 6:33080 (DOE/ER/10345—2)
**OSTEODENSITOMETRY**
**Measuring Methods**
Evaluation of the diagnostic sensitivity of scattering measurements of bone density, 6:33869 (CONF-800433—)
**OTEC**
*See OCEAN THERMAL ENERGY CONVERSION*
**OTEC POWER PLANTS**
*See OCEAN THERMAL POWER PLANTS*
**OVARIES**
**Delayed Radiation Effects**
Experimental radiation carcinogenesis: what have we learned ($^{60}$Co; fission neutrons; mice), 6:33895
**OXIDES**
**Volatility**
Predictive calculations of volatilities of metals and oxides in steam-containing environments, 6:33055 (UCRL—85553)
**OXIRANS**
*See EPOXIDES*
**OXYGEN**
**Activation Analysis**
Determination of low-Z elements simultaneously by $^{3}$HE-induced nuclear wastes, 6:33580 (LBL—11986)
Studies of Oxygen and Nitrogen in coal conversion liquids by 14 MeV INAA, 6:33816 (CONF-800433—)
**Removal**
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, October-December 1979, 6:32813 (DOE/ET/14700—1)
Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1980, 6:32814 (DOE/ET/14700—2)
**Thermal Analysis**
Determination of low-Z elements simultaneously by $^{3}$HE-induced nuclear wastes, 6:33580 (LBL—11986)
**Uptake**
Cytotoxic reactions of free radical species of oxygen, 6:33852
**OXYGEN 16 REACTIONS**
**Elastic Scattering**
Multiple Coulomb polarization potential for heavy ion scattering, 6:34025
**OXYGEN 17**
**Differential Cross Sections**
Search for resonances in $^{12}C(^{9}Be,\alpha)^{17}O$, 6:34003
**Energy Levels**
Search for resonances in $^{12}C(^{9}Be,\alpha)^{17}O$, 6:34003
**OXYGEN 18**
**Hypernuclei**
Experimental study of the sigma-nucleon system through the reaction d(K,$\pi$)SIGMA N. Progress report, January 1, 1981-December 31, 1981, 6:33967 (DOE/ER/04195—5)
**OXYGEN 18 TARGET**
**Photonuclear Reactions**
Measurement of the $^{18}$O photonuclear cross sections as a test of a bremsstrahlung unfolding technique, 6:34002
**OXYGEN COMPOUNDS**
**Hexagonal Lattices**
Crystal structure and stoichiometry of the Ca/sub 2+x/Nd/sub 8-x/(SiO$_4$)$_6$O/sub 2-1/2x/ system, 6:33591 (PNL-SA—9377)
**Stoichiometry**
Crystal structure and stoichiometry of the Ca/sub 2+x/Nd/sub 8-x/(SiO$_4$)$_6$O/sub 2-1/2x/ system, 6:33591 (PNL-SA—9377)
**OXYGEN EFFECT (RADIOBIOLOGY)**
*See OXYGEN*
**OXYGEN LOGS**
*See NEUTRON-GAMMA LOGGING*
**OXYGEN METERS**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**OXYMETHYLENE**
*See FORMALDEHYDE*
**OZONE**
**Biological Effects**
Variation in plant response to ozone: a conceptual model of physiological events, 6:33908 (CONF-8009172—1)
**Chemical Reaction Yield**
Reactions of nitrogen oxides, ozone and sulfur in power plant plumes, 6:33744 (EPRI-EA—270)

## P

**PACIFIC NORTHWEST REGION**
*See also ALASKA*
*WASHINGTON*
**Renewable Energy Sources**
Proceedings of the Pacific Northwest alternative and renewable energy resources conference, 6:33432 (CONF-7910232—)
**PAINTS**
**Bonding**
Manganese glass-molybdenum metallized and copper brazed 99.5% alumina ceramics, 6:33549 (MLM—2850)
**Phase Diagrams**
Manganese glass-molybdenum metallized and copper brazed 99.5% alumina ceramics, 6:33549 (MLM—2850)
**PALLADIUM**
**Ion Exchange Chromatography**
Chromatographic separation of metal ions on macroreticular anion-exchange resins of a low capacity, 6:33587
**PALLADIUM ALLOYS**
**Crystal-Phase Transformations**
Soft phonons and magnetic ordering in the $\gamma$-phase transition metal alloys Fe/sub 1-x/Pd/sub x/, 6:34043 (BNL—30037)
**Magnetization**
Soft phonons and magnetic ordering in the $\gamma$-phase transition metal alloys Fe/sub 1-x/Pd/sub x/, 6:34043 (BNL—30037)
**PAPER INDUSTRY**
**Energy Models**
Process models for industry, 6:33464 (BNL—29880)
**PARACHUTES**
**Design**
Development of the ARIES parachute system, 6:33639 (SAND—81-0208C)

**Performance Testing**
Development of the ARIES parachute system, 6:33639 (SAND—81-0208C)
**PARKS (NUCLEAR)**
*See NUCLEAR PARKS*
**PARTICLE BEAM FUSION ACCELERATOR**
Drivers for light ion fusion, 6:34111 (CONF-801011—(Vol.2))
**PARTICLE DECAY**
**T Invariance**
Search for the violation of time-reversal invariance in K/sub μ3/ decays, 6:33965 (BNL—30026)
**PARTICLE SIZE CLASSIFIERS**
**Reviews**
Review of the literature on the use of trommels in waste processing and resource recovery, 6:33474 (DOE/CS/20167—6)
**Test Facilities**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**PARTICLE-INDUCED X-RAY EMISSION ANALYSIS**
*See X-RAY EMISSION ANALYSIS*
**PARTICLES**
*See also DROPLETS*
**Air Pollution Control**
Economics and control technology for NOx and particulate emissions from coal-fired power plants, 6:33272
**Equations of Motion**
Particle trajectories in quadrupole fringe fields, 6:33667
**PIXE Analysis**
Element analysis by PIXE of environmental samples of the Brazilian Cerrado, 6:33813 (CONF-800433—)
**PARTICULATES**
**Activation Analysis**
Environmental pollutant studies: FY 1980 (Lead abstract), 6:33746 (LBL—11986)
**Air Pollution Control**
Soot formation in synthetic fuel droplets. Third quarterly technical progress report, April 1 to June 30, 1981, 6:33743 (DOE/PC/30298—T3)
**Chemical Analysis**
Survey of particulate emission macro- and micro-sampling and sizing methods and real-time monitoring and sizing methods, 6:33742 (DOE/FC/10193—T1)
**Particle Size**
Survey of particulate emission macro- and micro-sampling and sizing methods and real-time monitoring and sizing methods, 6:33742 (DOE/FC/10193—T1)
**Sampling**
Survey of particulate emission macro- and micro-sampling and sizing methods and real-time monitoring and sizing methods, 6:33742 (DOE/FC/10193—T1)
**Thermal Analysis**
Environmental pollutant studies: FY 1980 (Lead abstract), 6:33746 (LBL—11986)
**PASSIVE SOLAR COOLING SYSTEMS**
**Cost**
Performance predictions of passive solar commercial buildings, 6:33161 (CONF-811034—1)
**Design**
Performance predictions of passive solar commercial buildings, 6:33161 (CONF-811034—1)
Summary of passive solar multi-family design workshops, 6:33177 (MASEC-CF—81-035)
**Economic Analysis**
Comparative economic performance of selected passive solar heating and cooling technologies, 6:33159 (BNL—51394)
**Performance**
Performance predictions of passive solar commercial buildings, 6:33161 (CONF-811034—1)
**PASSIVE SOLAR HEATING SYSTEMS**
*See also DIRECT GAIN SYSTEMS*
*TROMBE WALLS*
*WATER WALLS*
**Comparative Evaluations**
Comparative thermal performance of direct gain, Trombe, and sunspace walls, 6:33158 (BNL—29970)
Passive-solar retrofit study for the United States Navy, 6:33170 (LA-UR—81-2500)
**Construction**
Vocational-technical instructors passive-solar training workshop, 6:33175 (MASEC-CF—81-019)
**Cost**
Performance predictions of passive solar commercial buildings, 6:33161 (CONF-811034—1)
**Design**
MASEC Solar 80 home designs, 6:33178 (MASEC-PA—80-007)
Performance predictions of passive solar commercial buildings, 6:33161 (CONF-811034—1)
Summary of passive solar multi-family design workshops, 6:33177 (MASEC-CF—81-035)
Vocational-technical instructors passive-solar training workshop, 6:33175 (MASEC-CF—81-019)
**Economic Analysis**
Comparative economic performance of selected passive solar heating and cooling technologies, 6:33159 (BNL—51394)
**Natural Convection**
Heating remote rooms in passive solar buildings, 6:33171 (LA-UR—81-2518)
**Performance**
Comparative thermal performance of direct gain, Trombe, and sunspace walls, 6:33158 (BNL—29970)
Performance predictions of passive solar commercial buildings, 6:33161 (CONF-811034—1)
**Performance Testing**
Passive-solar retrofit study for the United States Navy, 6:33170 (LA-UR—81-2500)
**Program Management**
Evaluation of the passive solar for agriculture program, 6:33179 (MASEC/R—81-045)
**Retrofitting**
Passive-solar retrofit study for the United States Navy, 6:33170 (LA-UR—81-2500)
**PBFA**
*See PARTICLE BEAM FUSION ACCELERATOR*
**PDU**
*See PROCESS DEVELOPMENT UNITS*
**PEARL SPAR**
*See DOLOMITE*
**PEAT**
**Anaerobic Digestion**
Peat biogasification development program, 6:33081 (DOE/ET/14696—T6)
**Chemical Composition**
Reconnaissance peatland surveys, 6:32902 (DOE/ET/14692—T1)
**Gasification**
Hydrogasification PDU studies, 6:32846
Single-stage fluidized-bed gasification, 6:32845
**Resource Assessment**
Inventory of peat resources Koochiching County, Minnesota. Appendix E. Site descriptions, 6:32897 (DOE/ET/14692—T2App.E)
Inventory of peat resources, Koochiching County, Minnesota, 6:32896 (DOE/ET/14692—T2App.A-D)
Peat deposits of Dismal Swamp pocosins: Camden, Currituck, Gates, Pasquotank, and Perquimans Counties, North Carolina, 6:32898 (DOE/ET/14693—T3)
Reconnaissance peatland surveys, 6:32902 (DOE/ET/14692—T1)
**Water Removal**
Hydrogasification PDU studies, 6:32846
Peat dewatering: solvent extraction, 6:32942
**PENETRATORS**
**Ultrasonic Testing**
Ultrasonic evaluation of U - 3/4 Ti penetrators by amplitude and frequency analysis, 6:33655 (RFP—3208)
**PENETROMETERS**
**Uses**
Application of a roof bolt hole penetrometer to the determination of in situ strength of coal-measure sediments, 6:32917

**PENNSYLVANIA**
**Air Pollution Monitors**
Design and implementation of a demonstration supplementary control system, 6:33271 (MIT-EL—80-033)
**PENTAERYTHRITOL TETRANITRATE**
*See PETN*
**PEOPLES REPUBLIC OF CHINA**
*See CHINA*
**PEPTIDES**
**Molecular Structure**
Computer simulation of organic and biological molecules, 6:33846 (LBL—12979)
**PERCHLORATES**
**Chemical Reactions**
Rate of reaction of superoxide radical with chloride-containing species, 6:33598
**PERSONNEL**
*See also MILITARY PERSONNEL*
**Occupational Diseases**
Problems in evaluating health effects of occupational and environmental exposures, 6:33891 (PNL-SA—9632)
**PERSONNEL MONITORING**
Hand and shoe monitor using air ionization probes (Patent), 6:33693
**PETN**
*(Pentaerythritol tetranitrate.)*
**Detonations**
Reaction rates from pressure-gauge measurements in reacting explosives, 6:33710 (LA-UR—81-2482)
**PETROCHEMICAL PLANTS**
**Planning**
Planning an integrated Mexican petrochemical industry, 6:32979
**PETROLEUM**
*See also OIL WELLS*
*SHALE OIL*
**Classification**
Source of oil for the western part of the Tarimu Basin, 6:32964
**Demand Factors**
Models for forecasting energy use in the US farm sector. Final report, 6:33470 (EPRI-EA—1956(Vol.1))
**Enhanced Recovery**
Cogeneration potential: enhanced oil recovery. Final report, 6:32970 (EPRI-EM—1996)
Economics of enhanced oil recovery and its position relative to synfuels, 6:32976
Improved polymers for enhanced oil recovery: synthesis and rheology. Third annual report, October 1979-September 1980, 6:32968 (DOE/ET/12038—T3)
Relational methodology for integrating and analyzing field test and research data describing enhanced oil recovery, 6:32967 (DOE/ET/10145—72)
**Environmental Transport**
Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)
**Exports**
US institutions: the Export-Import Bank, 6:32983 (EPRI-WS—79-182)
**Fuel Supplies**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
Prospects for diversifying sources of imported oil and gas supplies, 6:33407 (EPRI-WS—79-182)
Workshop proceedings: world oil and natural gas supplies, 6:32982 (EPRI-WS—79-182)
**Geochemistry**
Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)
**Imports**
Prospects for diversifying sources of imported oil and gas supplies, 6:33407 (EPRI-WS—79-182)
US institutions: the Export-Import Bank, 6:32983 (EPRI-WS—79-182)
**Market**
World oil prices, 6:33406 (EPRI-WS—79-182)
**Meetings**
Workshop proceedings: world oil and natural gas supplies, 6:32982 (EPRI-WS—79-182)
**Prices**
World oil prices, 6:33406 (EPRI-WS—79-182)
**Production**
World oil resource estimates: differences and difficulties, 6:33414 (EPRI-WS—79-182)
**Storage Facilities**
Microseismic activity observed during depressurization of an oil storage cavern in rock salt, 6:32987 (LA-UR—81-2622)
**Supply and Demand**
Basic facts about Colorado's energy resources and reserves, 6:33386
**Taxes**
Rent-skimmers, techniques for risk minimization, and impact on incentives, 6:33409 (EPRI-WS—79-182)
**Technology Assessment**
Technology characterizations: environmental information handbook. Second edition, 6:33840 (DOE/EP—0028)
**PETROLEUM DEPOSITS**
*See also OIL FIELDS*
**Geologic Traps**
Mechanism of the formation of diapiric structural traps in Dongying depression, Shandong, 6:32962
**Geology**
Discussions on the main periods and threshold temperature (depth) of oilgeneration in the Songliao basin, 6:32966
Occurrence of the oil pool in the metamorphosed basement in Yaerxia in the western part of the Jiuquan Basin, 6:32963
Occurrence of oil in the complex fault-blocks in the Jiyang sag, 6:32965
Source of oil for the western part of the Tarimu Basin, 6:32964
**Resource Assessment**
Comments on oil and gas reserves in Mexico, 6:33416 (EPRI-WS—79-182)
World oil and gas reserves, 6:33413 (EPRI-WS—79-182)
**PETROLEUM DISTILLATES**
**Combustion**
Design and preliminary results of a fuel flexible industrial gas turbine combustor, 6:32950
**PETROLEUM INDUSTRY**
**Economic Impact**
Mexico's oil and gas: a realistic perspective, 6:33417 (EPRI-WS—79-182)
**Financial Assistance**
US institutions: the Export-Import Bank, 6:32983 (EPRI-WS—79-182)
**Forecasting**
World oil prices, 6:33406 (EPRI-WS—79-182)
World oil resource estimates: differences and difficulties, 6:33414 (EPRI-WS—79-182)
**Political Aspects**
Politics of oil and gas, 6:33412 (EPRI-WS—79-182)
**PETROLEUM REFINERIES**
Feasibility of the high temperature gas-cooled reactor for cogeneration of process steam and electric power for a large oil refinery, 6:33322 (DOE/ET/34222—1)
**By-Products**
Feasibility and economic study of medium-Btu coal gas blended with high-Btu by-product gas as an industrial energy source at Billings, Montana. Final report, 6:33082 (DOE/FE/20219—2)
**Fuel Consumption**
Maximizing efficiency of fuel production and utilization, 6:33489
**PHASEOLUS**
**Radionuclide Kinetics**
Factors affecting radionuclide availability to vegetables grown at Los Alamos, 6:33903
**PHENIX REACTOR**
**Construction**
Achievements, findings, and lessons of the Phenix LMFBR power plant experience. Final report, 6:33305 (EPRI-NP—1973)

**Reactor Maintenance**
Achievements, findings, and lessons of the Phenix LMFBR power plant experience. Final report, 6:33305 (EPRI-NP—1973)
**Reactor Operation**
Achievements, findings, and lessons of the Phenix LMFBR power plant experience. Final report, 6:33305 (EPRI-NP—1973)
**Reactor Start-Up**
Achievements, findings, and lessons of the Phenix LMFBR power plant experience. Final report, 6:33305 (EPRI-NP—1973)

**PHENOL**
**Chemical Reactions**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)

**PHENOLS**
*See also NAPHTHOLS*
*PHENOL*
**Decomposition**
High temperature electrical conductivity and thermal decomposition of phenolic- and silicon-based dielectrics for fireset housings, 6:33560 (SAND—81-0786)
**Electric Conductivity**
High temperature electrical conductivity and thermal decomposition of phenolic- and silicon-based dielectrics for fireset housings, 6:33560 (SAND—81-0786)

**PHENYLAMINE**
*See ANILINE*

**PHOSPHATIDES**
*See PHOSPHOLIPIDS*

**PHOSPHINES**
**Chemisorption**
Processes and techniques, 6:32839 (LBL—12000)

**PHOSPHOLIPIDS**
**Biological Effects**
In vivo metabolism of a new class of biologically active phospholipids: 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine, a platelet activating-hypotensive phospholipid, 6:33864
**Metabolism**
In vivo metabolism of a new class of biologically active phospholipids: 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine, a platelet activating-hypotensive phospholipid, 6:33864

**PHOSPHORUS**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Metallurgical Effects**
Relative effects of S, Sb and P on the intergranular fracture of iron and nickel tested at cathodic potentials, 6:33531 (PNL-SA—9446)

**PHOSPHORUS 31 TARGET**
**Electron Reactions**
Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)

**PHOSPHORUS ADDITIONS**
**Amorphous State**
Structural relaxation rates in amorphous Metglas alloys $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_{80}B_{80}$, 6:33523 (LA-UR—81-2444)
**Electric Conductivity**
Structural relaxation rates in amorphous Metglas alloys $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_{80}B_{80}$, 6:33523 (LA-UR—81-2444)

**PHOTOCHEMISTRY**
**Research Programs**
Fundamental interactions, 6:33569 (LBL—12000)

**PHOTODISINTEGRATION**
*See PHOTONUCLEAR REACTIONS*

**PHOTOELECTROCHEMICAL CELLS**
**Photoanodes**
Luminescent photoelectrochemical cells. 5: multiple emission from tellurium-doped cadmium sulfide photoelectrodes and implications regarding excited state communication, 6:33105 (A—093692)
**Stability**
Photoelectrochemical solar cells: stabilization of small-band-gap semiconductor in aqueous solution by surface-attached organic conducting polymer, 6:33120 (SERI/TP—233-1388)

**PHOTOGRAPHS**
*See IMAGES*

**PHOTON ACTIVATION ANALYSIS**
*See ACTIVATION ANALYSIS*

**PHOTON BEAMS**
**Electron Detachment**
Photodetachment cross sections for $He^-$ ($^4P^o$), 6:33961

**PHOTON DETECTION (GAMMA)**
*See GAMMA DETECTION*

**PHOTONUCLEAR REACTIONS**
**Cross Sections**
Measurement of the $^{18}O$ photonuclear cross sections as a test of a bremsstrahlung unfolding technique, 6:34002
**Knock-Out Reactions**
Comparison of pion and photon induced reactions on complex nuclei, 6:34001

**PHOTOSYNTHESIS**
**Global Aspects**
Reduction of photosynthetically active radiation under extreme stratospheric aerosol loads, 6:33745 (LA—8938-MS)

**PHOTOVOLTAIC CONVERSION**
**Bibliographies**
Solar photovoltaics: a bibliography with abstracts. Quarterly update, April-June 1981, 6:33122 (TAC/SP—81-002)

**PHOTOVOLTAIC POWER SUPPLIES**
**Capital**
Availability of capital for developing photovoltaic markets, 6:33128 (MIT-EL—79-042)
**Computer Codes**
Photovoltaic market analysis program: background, model development, applications and extensions, 6:33098 (MIT-EL—81-012)
PV1 model verification and validation, 6:33132 (MIT-EL—81-004)
**Computerized Simulation**
Mississippi County Community College Solar Photovoltaic Project. Final report, 6:33124 (DOE/ET/20347—T1)
Photovoltaic assisted residence with supplemental battery storage: searching for a complementarity, 6:33126 (MIT-EL—79-016)
**Cost**
Study of photovoltaic cost elements. Volume 1. Executive report. Volume 2. Project background. Final report, 6:33136 (SAND—81-7014/Vol.1-2)
Study of photovoltaic cost elements. Volume 3. Sandia National Laboratories photovoltaic systems design catalog. Final report, 6:33137 (SAND—81-7014/Vol.3)
Study of photovoltaic cost elements. Volume 4. Installation cost model for residential PV systems: users manual. Final report, 6:33138 (SAND—81-7014/Vol.4)

Study of photovoltaic cost elements. Volume 5. Installation cost model for intermediate PV systems: users manual. Final report, 6:33139 (SAND—81-7014/Vol.5)

**Design**

Integrated residential photovoltaic array development. Quarterly report No. 2, 6:33125 (DOE/JPL/955894—2)

Mississippi County Community College Solar Photovoltaic Project. Final report, 6:33124 (DOE/ET/20347—T1)

Study of photovoltaic cost elements. Volume 3. Sandia National Laboratories photovoltaic systems design catalog. Final report, 6:33137 (SAND—81-7014/Vol.3)

**Directories**

Photovoltaic product directory and buyers guide, 6:33135 (PNL—3853)

**Economic Analysis**

Economics of photovoltaics in the commercial, institutional, and industrial sectors, 6:33130 (MIT-EL—80-008)

Flywheel storage for photovoltaics: an economic evaluation of two applications, 6:33129 (MIT-EL—80-002)

Impact on photovoltaic worth of utility rate and reform and of specific market, financial, and policy variables: a commercial/industrial/institutional sector analysis, 6:33131 (MIT-EL—80-025)

Photovoltaic assisted residence with supplemental battery storage: searching for a complementarity, 6:33126 (MIT-EL—79-016)

**Financing**

Availability of capital for developing photovoltaic markets, 6:33128 (MIT-EL—79-042)

**Flywheel Energy Storage**

Flywheel storage for photovoltaics: an economic evaluation of two applications, 6:33129 (MIT-EL—80-002)

**Installation**

Study of photovoltaic cost elements. Volume 4. Installation cost model for residential PV systems: users manual. Final report, 6:33138 (SAND—81-7014/Vol.4)

Study of photovoltaic cost elements. Volume 5. Installation cost model for intermediate PV systems: users manual. Final report, 6:33139 (SAND—81-7014/Vol.5)

**Institutional Factors**

Photovoltaics and the national park service: an institutional analysis, 6:33102 (MIT-EL—80-007)

**Interconnected Power Systems**

PURPA and PV systems, 6:33434

**Investment**

Impact on photovoltaic worth of utility rate and reform and of specific market, financial, and policy variables: a commercial/industrial/institutional sector analysis, 6:33131 (MIT-EL—80-025)

**Lead-Acid Batteries**

Photovoltaic assisted residence with supplemental battery storage: searching for a complementarity, 6:33126 (MIT-EL—79-016)

**Manufacturers**

Photovoltaic product directory and buyers guide, 6:33135 (PNL—3853)

**Marketing Research**

Photovoltaic market analysis program: background, model development, applications and extensions, 6:33098 (MIT-EL—81-012)

**Mathematical Models**

Study of photovoltaic cost elements. Volume 1. Executive report. Volume 2. Project background. Final report, 6:33136 (SAND—81-7014/Vol.1-2)

**Performance**

Study of photovoltaic cost elements. Volume 3. Sandia National Laboratories photovoltaic systems design catalog. Final report, 6:33137 (SAND—81-7014/Vol.3)

**PHYSICAL PROPERTIES**

**Data Acquisition Systems**

Role of engineering judgement and the computer in the management of material property data, 6:33495 (CONF-800804—43)

**PILES**

*See FOUNDATIONS*

**PINCH EFFECT**

*See also REVERSE-FIELD PINCH*

*THETA PINCH*

**Laser-Produced Plasma**

Ultra-high-density plasma experiments: MHD simulations, 6:34062 (LA-UR—81-2572)

**PINES**

**Plant Growth**

Growth and yield of loblolly, slash, and longleaf pines in the South Carolina Sandhills: third measurement. Final report, 6:33886 (DOE/SR/10706—1)

**Productivity**

Growth and yield of loblolly, slash, and longleaf pines in the South Carolina Sandhills: third measurement. Final report, 6:33886 (DOE/SR/10706—1)

**PINS (FUEL)**

*See FUEL PINS*

**PION MINUS REACTIONS**

**Elastic Scattering**

Comparison of $\pi$i and $\pi^-$ elastic and inelastic scattering from $^{52}$Cr at 180 MeV, 6:34014

**Inelastic Scattering**

Comparison of $\pi^+$ and $\pi^-$ elastic and inelastic scattering from $^{52}$Cr at 180 MeV, 6:34014

**PION PLUS REACTIONS**

**Elastic Scattering**

Comparison of $\pi^+$ and $\pi^-$ elastic and inelastic scattering from $^{52}$Cr at 180 MeV, 6:34014

**Inelastic Scattering**

Comparison of $\pi^+$ and $\pi^-$ elastic and inelastic scattering from $^{52}$Cr at 180 MeV, 6:34014

**Knock-Out Reactions**

Two-nucleon pion absorption in $^{3}$sup(,)$^{4}$He, 6:33999

**PION REACTIONS**

**Elastic Scattering**

Corrections to the closure approximation for the pion-nucleon t-matrix inside the nucleus, 6:34004

**Inelastic Scattering**

Measurements of isospin mixing between the $1^+$ doublet in $^{12}$C using pion inelastic scattering, 6:34005

**Optical Models**

Corrections to the closure approximation for the pion-nucleon t-matrix inside the nucleus, 6:34004

**PIONS**

**Particle Production**

Finite particle number effects in high-energy nuclear collisions. Implications on pion spectra, 6:33971

**PIPELINE QUALITY GAS**

*See HIGH BTU GAS*

**PIPES**

**Welded Joints**

Measurement of strain across a transition joint interface using Moire fringes (Between 2 1/4 Cr-1 Mo and 316 ss pipes.), 6:33325 (R/M/N—1068)

**PITUITARY GLAND**

**Delayed Radiation Effects**

Experimental radiation carcinogenesis: what have we learned ($^{60}$Co; fission neutrons; mice), 6:33895

**PIXE**

*See X-RAY EMISSION ANALYSIS*

**PLANETARY NEBULAE**

**Rotation**

Evidence for planetary progenitor rotation and for the long term acceleration of the ejected nebular shell, 6:33938

**PLANTS**

*See also GRAMINEAE*
*MOSSES*
*TREES*

**Injuries**

Variation in plant response to ozone: a conceptual model of physiological events, 6:33908 (CONF-8009172—1)

**Radiation Monitoring**

Environmental monitoring in the vicinity of the Savannah River Plant. Annual report, 1980, 6:33801 (DPSPU—81-30-1)

**Radioactivity**

Environmental concentration and migration of $^{129}$I, 6:33767 (PNL-SA—9140)

Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)

**PLANTS (INDUSTRIAL)**
*See INDUSTRIAL PLANTS*
**PLANTS (POWER)**
*See POWER PLANTS*
**PLASMA**
*See also LASER-PRODUCED PLASMA*
**Charged-Particle Transport**
Techniques for measuring the alpha-particle distribution in magnetically confined plasmas, 6:34074
**Meetings**
Technology of controlled nuclear fusion, 6:34138 (CONF-801011—(Vol.3))
Technology of controlled nuclear fusion, 6:34101 (CONF-801011—(Vol.2))
**PLASMA DIAGNOSTICS**
Techniques for measuring the alpha-particle distribution in magnetically confined plasmas, 6:34074
**Emission Spectra**
Using spectral line profiles as a diagnostic of the plasma electron density, 6:34071 (UCID—19173)
**Energy Spectra**
Flux of hydrogen from tokamak devices, 6:34051 (CONF-801011—(Vol.1))
**Neutron Spectra**
Design of neutron streak camera for fusion diagnostics, 6:34072 (UCRL—86162)
**X-Ray Spectrometers**
Hyper-filter-fluorescer spectrometer for fusion x-ray diagnostics, 6:34073 (UCRL—86163)
**PLASMA HEATING**
*See also BEAM INJECTION HEATING*
*HIGH-FREQUENCY HEATING*
**Alfven Waves**
Kinetic theory of Alfven wave heating, 6:34057 (DOE/ET/53036—25)
**Plasma Instability**
Enhanced fusion product heating via the fast magnetosonic instability, 6:34052 (CONF-801011—(Vol.1))
**PLASMA INSTABILITY**
*See also PLASMA MACROINSTABILITIES*
Current driven nonideal instability in a force-free toroidal plasma, 6:34059 (GA-A—16418)
**PLASMA MACROINSTABILITIES**
*See also BALLOONING INSTABILITY*
*HELICAL INSTABILITY*
**Computer Codes**
GATO: an MHD stability code for axisymmetric plasmas with internal separatrices, 6:34060 (GA-A—16441)
**PLASMA SIMULATION**
Ultra-high-density plasma experiments: MHD simulations, 6:34062 (LA-UR—81-2572)
**PLASMA WAVES**
Electromagnetic kinetic toroidal eigenmodes for general MHD equilibria, 6:34068 (PPPL—1830)
**PLASTIC SCINTILLATION DETECTORS**
**Efficiency**
Contribution of carbon interactions to the neutron counting efficiency of organic scintillators, 6:33695
**PLATES**
*(Thicker than SHEETS or FOILS.)*
**Velocity**
Free-surface velocity measurements of plates driven by reacting and detonating RX-03-BB and PBX-0404, 6:33715 (UCRL—86372)
**PLATINUM**
**Ion Exchange Chromatography**
Chromatographic separation of metal ions on macroreticular anion-exchange resins of a low capacity, 6:33587
**Sorptive Properties**
Processes and techniques, 6:32839 (LBL—12000)
**PLATINUM ALLOYS**
**Catalytic Effects**
Preparation and evaluation of advanced electrocatalysts for phosphoric acid fuel cells. Sixth quarterly report, April-June 1981, 6:33440 (DOE/NASA/0176—81/2)
**PLOIDY**
**Temperature Dependence**
Endomitotic effect of a cell cycle mutation of Saccharomyces cerevisiae, 6:33860
**PLUTONIUM**
**Adsorption**
Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)
**Critical Mass**
Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)
**Dissolution**
Recovery of americium-241 from aged plutonium metal, 6:33572 (DP—1577)
**Environmental Transport**
Plutonium as a tracer for studies of settling processes in a slow body of running water, 6:33826 (CONF-800433—)
**Ion Exchange Chromatography**
Recovery of americium-241 from aged plutonium metal, 6:33572 (DP—1577)
**Production**
Some political issues related to future special nuclear materials production, 6:33061 (LA—8969-MS)
**Purification**
Chemistry research and development. Annual progress report, November 1, 1979-October 31, 1980, 6:33622 (RFP—3180)
**Recovery**
Chemistry research and development. Annual progress report, November 1, 1979-October 31, 1980, 6:33622 (RFP—3180)
**Solubility**
Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)
**Solvent Extraction**
Recovery of americium-241 from aged plutonium metal, 6:33572 (DP—1577)
**Superconductivity**
Hill plots and americium, 6:34048
**Thermodynamic Properties**
Chemistry research and development. Annual progress report, November 1, 1979-October 31, 1980, 6:33622 (RFP—3180)
**PLUTONIUM 238**
**Fabrication**
$^{239}$Pu fuel form processes. Quarterly report, October-December 1980, 6:33070 (DPST—80-128-4)
**Radiation Monitoring**
Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)
**Radioecological Concentration**
Factors affecting radionuclide availability to vegetables grown at Los Alamos, 6:33903
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)
**Radioisotope Heat Sources**
$^{238}$Pu fuel form processes. Quarterly report, October-December 1980, 6:33070 (DPST—80-128-4)
Space nuclear safety and fuels program. Progress report, April 1981, 6:33072 (LA—8968-PR)
**PLUTONIUM 239**
**Radiation Monitoring**
Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)
**Radioecological Concentration**
Factors affecting radionuclide availability to vegetables grown at Los Alamos, 6:33903
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)
**Renal Clearance**
Radioactivity measurements of former military personnel exposed to weapon debris, 6:33892
**PLUTONIUM 240**
**Radiation Monitoring**
Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)

**Radioecological Concentration**
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)

**PLUTONIUM 241**
**Radiation Monitoring**
Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)

**PLUTONIUM 242**
**Casting**
Chemistry research and development. Annual progress report, November 1, 1979-October 31, 1980, 6:33622 (RFP—3180)
**Decontamination**
Chemistry research and development. Annual progress report, November 1, 1979-October 31, 1980, 6:33622 (RFP—3180)

**PLUTONIUM BASE ALLOYS**
**Phase Transformations**
Pressure-induced transformation in a Pu-2at.% Al alloy, 6:33525 (LA-UR—81-2456)
Temperature-induced transformation in a Pu-2at.% Al alloy, 6:33524 (LA-UR—81-2455)

**PLUTONIUM DIOXIDE**
**Reaction Kinetics**
Oxygen potentials of plutonia and urania-plutonia solid solutions, 6:33541
**Thermodynamic Activity**
Oxygen potentials of plutonia and urania-plutonia solid solutions, 6:33541

**PLUTONIUM HYDRIDES**
**Thermodynamic Properties**
Chemistry research and development. Annual progress report, November 1, 1979-October 31, 1980, 6:33622 (RFP—3180)

**PLUTONIUM NITRATES**
**Safeguards**
Safeguards design for a plutonium concentrator: an applied estimation approach, 6:33058

**PNA**
*See POLYCYCLIC AROMATIC HYDROCARBONS*

**PNEUMATIC TRANSPORT**
**Erosion**
Design of refractories for resistance to high-temperature erosion-corrosion. Final report, 6:33547 (EPRI-AP—1955)
**Pulse Techniques**
Pneumatic conveying of fly ash in the pulse phase, 6:32873 (EPRI-WS—79-236)

**POLAND**
**Coordinated Research Programs**
Method of investigations, estimation, and classification of roofs in mines in the United States of America for the selection of suitable mechanized support for longwalls. Report No. 1: January 1, 1977-March 31, 1977, 6:32910 (DOE/TIC—11477)
**Underground Mining**
Emphasis in overseas research on underground coal mining: geomechanical implications (Australian report), 6:32904 (CSIRO—2)

**POLAR COMPOUNDS**
**Liquid Column Chromatography**
Liquid-liquid chromatography fractionation of organic compounds in complex mixtures: application to automobile exhaust, 6:33575 (IS-T—914)

**POLLUTION**
*(For nonradioactive pollution only; see also CONTAMINATION.)*
*See also AIR POLLUTION*
*CHEMICAL EFFLUENTS*
*NOISE POLLUTION*
*THERMAL POLLUTION*
*WATER POLLUTION*
**Monitoring**
Neutron activation for the determination of total halogenated organics, 6:33785 (CONF-800433—)

**POLLUTION CONTROL EQUIPMENT**
*See also BAGHOUSES*
*ELECTROSTATIC PRECIPITATORS*
*SCRUBBERS*
**Cost**
Particulate control for industrial coal fired boilers: the reverse gas fabric filter method, 6:32879
**Evaluation**
Particulate control for industrial coal fired boilers: the reverse gas fabric filter method, 6:32879
**Operation**
Particulate control for industrial coal fired boilers: the reverse gas fabric filter method, 6:32879

**POLOIDAL DIVERTORS**
**Design**
Poloidal divertor target for SLPX, 6:34142 (CONF-801011—(Vol.3))

**POLONIUM 210**
**Environmental Transport**
Determination of $^{210}Pb$ and $^{210}Po$ in the environment, 6:33799 (CONF-800433—)

**POLYACRYLATES**
**Chemical Radiation Effects**
New ion exchange membranes, 6:33616 (NASA-TM—81670)

**POLYCYCLIC AROMATIC HYDROCARBONS**
**Correlations**
Relation between concentrations of polynuclear aromatic hydrocarbons and black carbon, 6:33757 (LBL—11986)

**POLYENES**
**Radiolysis**
Transient phenomena in the pulse radiolysis of retinyl polyenes. I. Radical anions, 6:33618

**POLYMER FLOODING**
*See MICROEMULSION FLOODING*

**POLYMERS**
*See also ELASTOMERS*
*SILICONES*
**Breakdown**
Partial discharge inception and extinction studies in polymer film structures impregnated with compressed $SF_6$ gas, 6:33276 (CONF-811016—2)
**Research Programs**
Improved polymers for enhanced oil recovery: synthesis and rheology. Third annual report, October 1979-September 1980, 6:32968 (DOE/ET/12038—T3)

**POLYNUCLEAR HYDROCARBONS**
*See CONDENSED AROMATICS*

**POLYURETHANES**
**Aging**
Aging of Adiprene L-100/butanediol/trimethylolpropane stocks, 6:33069 (GEPP-TIS—587)

**PONDS**
*See LAKES*

**POOR PEOPLE**
*See LOW INCOME GROUPS*

**POPULATION DENSITY**
**Genetic Effects**
Density- and frequency-dependent selection at the Mdh-2 locus in Drosophila pseudoobscura, 6:33863
Fitness and density-dependent population growth in Drosophila melanogaster, 6:33862

**POROUS MATERIALS**
**Flow Models**
Proceedings of the workshop on numerical modeling of thermohydrological flow in fractured rock masses, 6:33047 (LBL—11566)
**Fluid Flow**
Development of an explicit finite-difference fluid flow model, 6:33922 (LBL—11566)
Flow in fractured porous media, 6:33051 (LBL—11566)
Importance of including fractures in thermohydrological modeling of flow through porous media, 6:33054 (LBL—11566)
Multidimensional numerical simulation of fluid flow in fractured porous media, 6:33050 (LBL—11566)
Porous media fluid flow, heat, and mass transport model with rock stress coupling, 6:33052 (LBL—11566)
**Fractures**
Importance of including fractures in thermohydrological modeling of flow through porous media, 6:33054 (LBL—11566)
Multidimensional numerical simulation of fluid flow in fractured porous media, 6:33050 (LBL—11566)

**Heat Transfer**
Porous media fluid flow, heat, and mass transport model with rock stress coupling, 6:33052 (LBL—11566)
**Mass Transfer**
Porous media fluid flow, heat, and mass transport model with rock stress coupling, 6:33052 (LBL—11566)
**Natural Convection**
Study of non-Darcy natural convection from a vertical heated surface in a saturated porous medium, 6:33963 (PNL-SA—9712)
**Permeability**
Multidimensional numerical simulation of fluid flow in fractured porous media, 6:33050 (LBL—11566)
**Two-Phase Flow**
SHAFT79, 6:33211 (LBL—11566)

**PORTSMOUTH CENTRIFUGE ENRICHMENT PLANT**
**Nuclear Materials Management**
Gamma-ray spectrometric determination of $UF_6$ assay with 1 percent precision for international safeguards. Part 1. Product and feed in 1S and 2S sample cylinders, 6:33576 (K/OA—5014-Rev.1)

**POSITRON CHANNELING**
**Diffusion**
Slow positrons in the study of surface and near-surface defects, 6:33953 (BNL—29798)

**POSITRON COMPUTED TOMOGRAPHY**
**Positron Detection**
Myocardial perfusion scintigraphy using a new technique, the mesh chamber. Progress report, September 1, 1978-May 1, 1981, 6:33689 (DOE/EV/04969—3)

**POSITRONS**
**Pair Production**
Two-photon contributions to lepton production in pp scattering, 6:33980

**POTASSIUM**
**Chemical Reaction Kinetics**
Model compound study of the mechanism of $sp^3$-$sp^3$ carbon-carbon cleavage during the reduction of coals (Bibenzyl, diphenylmethane, $\alpha$-benzylnaphthalene), 6:33606 (CONF-810914—4)
**Emission Spectroscopy**
Automated on-line determination of PPB levels of sodium and potassium in low-Btu coal gas and fluidized bed combustor exhaust by atomic emission spectrometry, 6:32861 (IS-M—330)
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)

**POTASSIUM 39 TARGET**
**Argon 40 Reactions**
Two-proton correlation measurements in 800 and 400 MeV/nucleon heavy-ion reactions, 6:34008

**POTASSIUM CHLORIDES**
**Physical Properties**
Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981, 6:33192 (DOE/CS/30174—T2Vol.1)
**Sorption**
Studies of the regeneration of activated bauxite used as granular sorbent for the control of alkali vapors from hot flue gas of coal combustion, 6:33269 (ANL/CEN/FE—81-1)

**POTASSIUM COMPOUNDS**
Use of alkali metal-acid phosphates for elevated temperature water electrolysis, 6:33077 (UCRL—86623)
**Catalytic Effects**
Exploratory study of coal-conversion chemistry. Quarterly report, December 20, 1979-March 19, 1980, 6:32815 (DOE/ET/14855—6)

**POTASSIUM IODIDES**
**Chemical Reactions**
Ammonium iodide-potassium iodide mixed crystals in equilibrium with aqueous and aqueous-2-propanol solutions, 6:33596

**POTASSIUM NITRATES**
**Physical Properties**
Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981, 6:33192 (DOE/CS/30174—T2Vol.1)

**POTASSIUM OXIDES**
**Catalytic Effects**
Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 January 1981-31 March 1981, 6:32831 (DOE/PC/30021—T4)

**POTASSIUM PERCHLORATES**
**Pyrolysis**
Catalytic decomposition of potassium perchlorate, 6:33597

**POWER DEMAND**
**Forecasting**
ORNL rural electric-energy-demand forecasting model, 6:33427 (ORNL/TM—7863)
Regional load-curve models: scenario and forecast using the DRI model. Final report (Forecasts of electric power loads in 32 US regions), 6:33422 (EPRI-EA—1672(Vol.3))
**Regional Analysis**
Regional load-curve models: scenario and forecast using the DRI model. Final report (Forecasts of electric power loads in 32 US regions), 6:33422 (EPRI-EA—1672(Vol.3))

**POWER DISTRIBUTION SYSTEMS**
**Electric Cables**
Research to develop guidelines for cathodic protection of concentric neutral cables. Interim report, 6:33280 (EPRI-EL—1970(Vol.1))
Research to develop guidelines for cathodic protection of concentric neutral cables. Interim report, 6:33281 (EPRI-EL—1970(Vol.2))

**POWER GENERATION**
*See also COGENERATION*
Generation planning system: methodology and case study. Final report, 6:33423 (EPRI-EA—1807)
**Decision Making**
Evaluating R and D options under uncertainty. Volume 1. Pulverized-coal development strategies. Final report, 6:33424 (EPRI-EA—1964(Vol.1))
Evaluating R and D options under uncertainty. Volume 2. Atmospheric fluidized-bed combustion commercialization strategies. Final report, 6:33425 (EPRI-EA—1964-Vol.2)
Evaluating R and D options under uncertainty. Volume 3. An electric-utility generation-expansion planning model. Final report, 6:33426 (EPRI-EA—1964(Vol.3))
**Economics**
New perspectives on public power, 6:33428
**Energy Consumption**
Impact of climate and energy, and the $CO_2$ problem, 6:33275
**Energy Sources**
New perspectives on public power, 6:33428
**Environmental Impacts**
Impact of climate and energy, and the $CO_2$ problem, 6:33275

**Planning**
Evaluating R and D options under uncertainty. Volume 1. Pulverized-coal development strategies. Final report, 6:33424 (EPRI-EA—1964(Vol.1))
Evaluating R and D options under uncertainty. Volume 3. An electric-utility generation-expansion planning model. Final report, 6:33426 (EPRI-EA—1964(Vol.3))
**Technology Assessment**
Evaluating R and D options under uncertainty. Volume 1. Pulverized-coal development strategies. Final report, 6:33424 (EPRI-EA—1964(Vol.1))

**POWER PLANTS**
*See also DUAL-PURPOSE POWER PLANTS*
*FUEL CELL POWER PLANTS*
*MHD POWER PLANTS*
*THERMAL POWER PLANTS*
*THERMONUCLEAR POWER PLANTS*
*WIND POWER PLANTS*
**Environmental Effects**
MAP3S/RAINE emissions inventory. Progress report, December 1980, 6:33725 (BNL—51378)
**Environmental Impacts**
MAP3S/RAINE emissions inventory. Progress report, December 1980, 6:33725 (BNL—51378)
**Meetings**
Proceedings of the Power Plant Dynamics, Control and Testing Symposium, 4th, 1980, 6:33334

**POWER POOLS**
*See INTERCONNECTED POWER SYSTEMS*

**POWER REACTORS**
*See also CLINCH RIVER BREEDER REACTOR*
*DAVIS BESSE-1 REACTOR*
*EBR-2 REACTOR*
*MONTICELLO REACTOR*
*PHENIX REACTOR*
*PROCESS HEAT REACTORS*
*THREE MILE ISLAND-2 REACTOR*
*VRAIN REACTOR*
**Meltdown**
Propagation of a liquid-liquid explosion, 6:33360 (LA—8971-MS)

**POWER SUBSTATIONS**
**Load Analysis**
Utilization of waste heat from major transformer substations. Volume 1. Generic study. Final report, 6:33477 (EPRI-EM—1968(Vol.1))
Utilization of waste heat from major transformer substations. Volume 2. Site-specific study. Final report, 6:33478 (EPRI-EM—1968(Vol.2))

**POWER SYSTEMS**
*See also INTERCONNECTED POWER SYSTEMS*
**Capacity**
Evaluating the role of uncertainty in electric utility capacity planning (Appendices B and C), 6:33419 (DOE/EIA/10612—T26-Apps.B-C)
Evaluating the role of uncertainty in electric utility capacity planning, 6:33390 (DOE/EIA/10612—T26)
**Economics**
Evaluating the role of uncertainty in electric utility capacity planning (Appendices B and C), 6:33419 (DOE/EIA/10612—T26-Apps.B-C)
Evaluating the role of uncertainty in electric utility capacity planning, 6:33390 (DOE/EIA/10612—T26)
**Emergency Plans**
Federal electrical-emergency preparedness is inadequate, 6:33420 (EMD—81-50)
**Off-Peak Energy Storage**
Sodium chloride battery development program for load leveling. Interim report, January 1, 1975-December 31, 1975, 6:33263 (EPRI-EM—230)
**Planning**
Evaluating the role of uncertainty in electric utility capacity planning (Appendices B and C), 6:33419 (DOE/EIA/10612—T26-Apps.B-C)
Evaluating the role of uncertainty in electric utility capacity planning, 6:33390 (DOE/EIA/10612—T26)
**Reliability**
Evaluating the role of uncertainty in electric utility capacity planning (Appendices B and C), 6:33419 (DOE/EIA/10612—T26-Apps.B-C)
Evaluating the role of uncertainty in electric utility capacity planning, 6:33390 (DOE/EIA/10612—T26)

**POWER TRANSMISSION LINES**
**Corona Discharges**
Investigation of corona and field effects of ac/dc hybrid transmission lines, 6:33286
**Electric Cables**
Laboratory development of +-600 kV dc pipe cable system, 6:33284
**Electric Currents**
Investigation of geomagnetically induced currents in the proposed Winnipeg-Duluth-Twin Cities 500-kV transmission line. Final report, 6:33279 (EPRI-EL—1949)
**Electric Fields**
Investigation of corona and field effects of ac/dc hybrid transmission lines, 6:33286
**Electric Grounds**
Application of high-speed grounding switches for single-pole reclosing on 500 kV power systems, 6:33283
**Electrical Transients**
Investigation of geomagnetically induced currents in the proposed Winnipeg-Duluth-Twin Cities 500-kV transmission line. Final report, 6:33279 (EPRI-EL—1949)
**Failures**
Conductor fatigue-life research. Final report, 6:33278 (EPRI-EL—1946)
**Fatigue**
Conductor fatigue-life research. Final report, 6:33278 (EPRI-EL—1946)
**Noise**
Formulas for predicting audible noise from overhead high voltage ac and dc lines, 6:33287

**POWER TRANSMISSION TOWERS**
**Foundations**
Impedance characteristics of large tower footings to a 100μs wide square wave of current, 6:33285

**PRASEODYMIUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)

**PREPARATION (SAMPLE)**
*See SAMPLE PREPARATION*

**PRESSURE VESSELS**
**Fabrication**
Effects of components of synfuels on soot formation. Quarterly technical progress report Number 3, April 1-June 30, 1981, 6:32947 (DOE/PC/30307—3)
**Installation**
Effects of components of synfuels on soot formation. Quarterly technical progress report Number 3, April 1-June 30, 1981, 6:32947 (DOE/PC/30307—3)
**Nondestructive Testing**
Focused line source linear array holography using a three dimensional computer reconstruction system, 6:33330
**Welded Joints**
Creep damage accumulation during thermal cycling of a transition joint, 6:33326 (R/M/R—207)
**Welding**
Development of automated welding process for field fabrication of thick walled pressure vessels, 6:33324 (DOE/ET/13511—T8)

**PRESSURIZED WATER REACTORS**
*See PWR TYPE REACTORS*

**PRIMARY COOLANT CIRCUITS**
**Heat Transfer**
Thermal-hydraulic differential sensitivity theory (LMFBR), 6:33312 (ORNL/CSD/TM—126)
**Hydraulics**
Thermal-hydraulic differential sensitivity theory (LMFBR), 6:33312 (ORNL/CSD/TM—126)

**PRISMS**
**Design**
Optical device with conical input and output prism faces (Patent), 6:33705

**PROBES**
**Testing**
Soot formation in synfuels. Second quarterly report, 1 January 1981-31 March 1981, 6:33083 (DOE/PC/30304—2)
**PROCESS DEVELOPMENT UNITS**
*See also DEMONSTRATION PLANTS*
**Design**
Low-cost solar-array project: experimental process system development unit for producing semiconductor-grade silicon using the silane-to-silicon process. Quarterly progress report, April-June 1981, 6:33109 (DOE/JPL/954334—19)
Module experimental process system development unit (MEPSDU). Quarterly report No. 2, March 1, 1981-May 31, 1981, 6:33113 (DOE/JPL/955902—81/2)
**Fabrication**
Low-cost solar-array project: experimental process system development unit for producing semiconductor-grade silicon using the silane-to-silicon process. Quarterly progress report, April-June 1981, 6:33109 (DOE/JPL/954334—19)
**PROCESS HEAT REACTORS**
**Economics**
Feasibility of the high temperature gas-cooled reactor for cogeneration of process steam and electric power for a large oil refinery, 6:33322 (DOE/ET/34222—1)
**Feasibility Studies**
Feasibility of the high temperature gas-cooled reactor for cogeneration of process steam and electric power for a large oil refinery, 6:33322 (DOE/ET/34222—1)
**Petroleum Refineries**
Feasibility of the high temperature gas-cooled reactor for cogeneration of process steam and electric power for a large oil refinery, 6:33322 (DOE/ET/34222—1)
**PROCESSING (WASTES)**
*See WASTE PROCESSING*
**PRODUCTION (HYDROGEN)**
*See HYDROGEN PRODUCTION*
**PROGRAMMING**
**Manuals**
Some notes on operating-system principles, 6:34196 (UCID—19076)
**PROMETHAZINE**
*See AMINES*
**PROPANE**
**Dehydrogenation**
Heat-supply system for a fluidized-bed reactor featuring an endothermic reaction, 6:32977
**PROPORTIONAL COUNTERS**
**Performance**
Design and performance of the new cathode readout proportional chambers in LASS, 6:33690 (SLAC-PUB—2642)
**Specifications**
Design and performance of the new cathode readout proportional chambers in LASS, 6:33690 (SLAC-PUB—2642)
**PROTECTION (RADIATION)**
*See RADIATION PROTECTION*
**PROTECTIVE COATINGS**
Fossil energy, 6:32862 (LBL—12000)
**PROTEINS**
*See also ALBUMINS*
*GLUCOPROTEINS*
*PEPTIDES*
**Genetic Effects**
Two-dimensional analysis of human lymphocyte proteins: I. An assay for lymphocyte effectors, 6:33847
**Metabolism**
Regulation of retinol-binding protein metabolism by glucocorticoid hormones in cultured $H_4II$ $EC_3$ liver cells, 6:33849
**Molecular Structure**
Computer simulation of organic and biological molecules, 6:33846 (LBL—12979)
**Structural Chemical Analysis**
Adenovirus type 2 early proteins: assignment of the early region 1A proteins synthesized in Vivo and in Vitro to specific mRNAs, 6:33874
**PROTON REACTIONS**
**Breakup Reactions**
Description of polarization analyzing powers for three-body breakup reactions, 6:33998
**Charge-Exchange Reactions**
Energy systematics of the giant Gamow-Teller resonance and a charge-exchange dipole spin-flip resonance, 6:34020
**Elastic Scattering**
Intermediate energy proton and light-ion scattering, 6:33995 (LA-UR—81-2410)
**Inclusive Interactions**
Inclusive proton spectra and total reaction cross sections for proton-nucleus scattering at 800 MeV, 6:33997 (LA—8937-T)
**Inelastic Scattering**
Intermediate energy proton and light-ion scattering, 6:33995 (LA-UR—81-2410)
Nuclear structure study at intermediate energies. Annual progress report, November 1980-July 1981, 6:33992 (DOE/ER/04215—5)
**Research Programs**
Nuclear structure study at intermediate energies. Annual progress report, November 1980-July 1981, 6:33992 (DOE/ER/04215—5)
**Total Cross Sections**
Energy dependence of nucleus-nucleus total cross sections, 6:34006
Inclusive proton spectra and total reaction cross sections for proton-nucleus scattering at 800 MeV, 6:33997 (LA—8937-T)
**PROTON-ANTIPROTON INTERACTIONS**
**Inclusive Interactions**
Inclusive $\pi^0$ and eta production from kaon, proton and antiproton beams in the triple-Regge region, 6:33972
**PROTON-PROTON INTERACTIONS**
**Inclusive Interactions**
Inclusive $\pi^0$ and eta production from kaon, proton and antiproton beams in the triple-Regge region, 6:33972
**Pair Production**
Two-photon contributions to lepton production in pp scattering, 6:33980
**PSYCHOLOGY**
**Technology Assessment**
Biotechnology in Canada: promises and concerns, 6:33836
**PSYCHOSES**
*See MENTAL DISORDERS*
**P-TYPE CONDUCTORS**
**Deposition**
Amorphous boron-silicon-hydrogen alloys for thin-film heterojunction solar cells. Quarterly technical progress report No. 3, 1 December 1980-28 February 1981, 6:33118 (SERI/PR—0-9010-3)
**PUBLIC BUILDINGS**
**Space Heating**
Utilization of waste heat from major transformer substations. Volume 2. Site-specific study. Final report, 6:33478 (EPRI-EM—1968(Vol.2))
**PUBLIC HEALTH**
**Pathology**
Trace element analysis of human hair by proton induced X-ray excitation PIXE, 6:33884 (CONF-800433—)
**PUBLIC UTILITY REGULATORY POLICIES ACT**
PURPA and PV systems, 6:33434
**PUERTO RICO**
**Aquatic Ecosystems**
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)
**Geology**
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)
**Oceanography**
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)

**PULSATING VARIABLE STARS**
**Pulsations**
RR Lyrae and BL Herculis variables, 6:33939
**PULSE GENERATORS**
*See also HIGH-VOLTAGE PULSE GENERATORS*
**Design**
Apparatus for generating nonlinear pulse patterns (Patent), 6:33659
**PULSED NEUTRON TECHNIQUES**
Feasibility of using a novel pulsed neutron source for in vivo: prompt gamma analysis, 6:33866 (CONF-800433—)
**PULVERIZERS**
**Failures**
Overview of major causes of pulverizer failures, 6:32935 (EPRI-WS—79-236)
**Manufacturers**
Overview of major causes of pulverizer failures, 6:32935 (EPRI-WS—79-236)
**Modifications**
Overview of major causes of pulverizer failures, 6:32935 (EPRI-WS—79-236)
**PUMP TURBINES**
**Design**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 8. Design approaches: UPH. Final report, 6:33371 (EPRI-EM—1589(Vol.8))
**Performance**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 8. Design approaches: UPH. Final report, 6:33371 (EPRI-EM—1589(Vol.8))
**PUMPED STORAGE POWER PLANTS**
**Design**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 8. Design approaches: UPH. Final report, 6:33371 (EPRI-EM—1589(Vol.8))
**Site Selection**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 8. Design approaches: UPH. Final report, 6:33371 (EPRI-EM—1589(Vol.8))
**PWR TYPE REACTORS**
*See also DAVIS BESSE-1 REACTOR*
*THREE MILE ISLAND-2 REACTOR*
**Control Rooms**
Evaluation of proposed control room improvements through analysis of critical operator decisions. Final report, 6:33333 (EPRI-NP—1982)
**Core Flooding Systems**
Brazing of sensors for high-temperature steam instrumentation systems, 6:33363
**Departure Nucleate Boiling**
Factors affecting post-DNB operation for light water reactors. Final report , 6:33351 (EPRI-NP—1999(Vol.1))
Factors affecting post-DNB operation for light water reactors. Final report, 6:33352 (EPRI-NP—1999(Vol.2))
**Fuel Cycle**
APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste, 6:33318 (BNL—29899)
**Fuel Management**
Engineering study of frequent refueling for improved uranium utilization in pressurized water reactors, 6:33297 (PNL-SA—9641)
**Loss of Coolant**
Analysis of short-term reactor cavity transient, 6:33342 (CONF-810606—74)
Posttest analysis of international standard problem 10 using RELAP4/MOD7, 6:33341 (CONF-810606—73)
**Spent Fuel Elements**
APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste, 6:33318 (BNL—29899)
**Spent Fuel Storage**
Possibility of multiple temperature maxima in geologic repositories for spent fuel from nuclear reactors, 6:33043
**Steam Generators**
Loss-of-feed water transients in PWR U-tube steam generators: simulation experiments and analysis, 6:33367
**PYRIDINE**
**Chemisorption**
Processes and techniques, 6:32839 (LBL—12000)
**PYRITE**
**Oxidation**
Kinetics of the removal of iron pyrite from coal by microbial catalysis, 6:33871
**Pyrolysis**
CaO interactions in the staged combustion of coal. Third quarterly technical progress report, April 1, 1981-June 30, 1981, 6:32946 (DOE/PC/30301—3)

## Q

**QUANTITATIVE CHEMICAL ANALYSIS**
**Feasibility Studies**
Feasibility study for the in vivo measurement of silicon and beryllium by nuclear techniques, 6:33868 (CONF-800433—)
**QUANTUM CHROMODYNAMICS**
**Gluon Model**
QCD, OZI, and evidence for glueballs, 6:33985 (BNL—29768)
**QUANTUM ELECTRODYNAMICS**
**Unified Gauge Models**
Fundamental tests and measures of the structure of matter at short distances, 6:33989 (SLAC-PUB—2776)
**QUARK MODEL**
**Magnetic Moments**
Why masses and magnetic moments satisfy naive quark model predictions, 6:33990
**Mass**
Why masses and magnetic moments satisfy naive quark model predictions, 6:33990
**QUARKONIUM**
**Spectroscopy**
Quarkonium spectroscopy, 6:33970 (SLAC-PUB—2761)
**QUARTZ**
**Thermodynamic Properties**
Shock-compression measurements at pressures greater than 1 TPa, 6:33521 (LA-UR—81-2426)
**QUINOLINES**
**Enthalpy**
Enthalpy measurement of coal-derived liquids. Technical progress report, May-July 1981 (186 to 732°F and 75, 100, and 200 psia), 6:32860 (DOE/PC/40787—1)

## R

**RACIAL GROUPS**
*See MINORITY GROUPS*
**RADIATION ACCIDENTS**
**Probability**
Probabilities of aircraft crashes at Rocky Flats and subsequent radioactive releases, 6:33768 (RFP—2462-Add.)
**RADIATION DECONTAMINATION**
*See DECONTAMINATION*
**RADIATION DETECTION**
*See also COSMIC RAY DETECTION*
*GAMMA DETECTION*
*NEUTRON DETECTION*
**Efficiency**
Evaluation of airborne radioactive Iodine and noble gas environmental monitors using short-lived research reactor-produced radionuclides, 6:33765 (CONF-800433—)
In situ determination of transuranic and fission product radionuclides, 6:33798 (CONF-800433—)
**RADIATION HAZARDS**
**Environmental Impacts**
Radiation, 6:33842 (DOE/EP/10012—1)

**Risk Assessment**
DARTAB: a program to combine airborne radionuclide environmental exposure data with dosimetric and health effects data to generate tabulations of predicted health impacts, 6:33889 (ORNL—5692)

**RADIATION HYGIENE**
*See RADIATION PROTECTION*

**RADIATION PROTECTION**
**Cost Benefit Analysis**
Dose/response relationships and policy formulation, 6:34042 (PNL-SA—9317)
**Government Policies**
Dose/response relationships and policy formulation, 6:34042 (PNL-SA—9317)
**Standards**
Dose/response relationships and policy formulation, 6:34042 (PNL-SA—9317)

**RADIATION SAFETY**
*See RADIATION PROTECTION*

**RADICALS**
*See also SUPEROXIDE RADICALS*
**Electron Spin Resonance**
Membrane oxidative damage, 6:33854 (LBL—11986)

**RADIOACTIVE BIOLOGICAL WASTES**
*See RADIOACTIVE WASTES*

**RADIOACTIVE EFFLUENTS**
*See also RADIOACTIVE WASTES*
**Radiation Hazards**
DARTAB: a program to combine airborne radionuclide environmental exposure data with dosimetric and health effects data to generate tabulations of predicted health impacts, 6:33889 (ORNL—5692)

**RADIOACTIVE MATERIALS**
*See also FISSION PRODUCTS*
*RADIOACTIVE WASTES*
*RADIOPHARMACEUTICALS*
**Radiation Monitoring**
Engineering assessment of inactive uranium mill tailings, Naturita Site, Naturita, Colorado, 6:33024 (DOE/UMT—012)
Summary of the engineering assessment of inactive uranium mill tailings, Naturita site, Naturita, Colorado, 6:33025 (DOE/UMT—012S)

**RADIOACTIVE PARTICULATES**
*See PARTICLES*

**RADIOACTIVE WASTE DISPOSAL**
Potential for lessened waste hazards from the thorium cycle by means of fusion symbiosis, 6:33066 (CONF-801011—(Vol.2))
**Aquifers**
Description and applications of the FE3DGW and CFEST three-dimensional finite-element models, 6:33053 (LBL—11566)
**Computerized Simulation**
Hydrologic studies support, INTERCOMP code conversion. Annual report. Research report 80/15-44, 6:33023 (DOE/RL/10119—1)
**Containers**
Effects of annular air gaps surrounding an emplaced nuclear waste canister in deep geologic storage, 6:33044
**Cost**
Engineering assessment of inactive uranium mill tailings, Naturita Site, Naturita, Colorado, 6:33024 (DOE/UMT—012)
Engineering assessment of inactive uranium mill tailings, Shiprock site, Shiprock, New Mexico, 6:33026 (DOE/UMT—0104)
Summary of the engineering assessment of inactive uranium mill tailings, Naturita site, Naturita, Colorado, 6:33025 (DOE/UMT—012S)
Summary of the engineering assessment of inactive uranium mill tailings, Shiprock Site, Shiprock, New Mexico, 6:33027 (DOE/UMT—0104S)
**Geologic Deposits**
Importance of creep failure of hard rock in the near field of a nuclear-waste repository, 6:33037 (LA-UR—81-2584)
Nuclear waste isolation, 6:33042
Technical progress report for the quarter, 1 January-31 March 1981, 6:33039 (ONWI—9-81-2)
**Heat Transfer**
Evaporative water loss from welded tuff, 6:33021
Possibility of multiple temperature maxima in geologic repositories for spent fuel from nuclear reactors, 6:33043
**High-Level Radioactive Wastes**
Technical progress report for the quarter, 1 January-31 March 1981, 6:33039 (ONWI—9-81-2)
**Low-Level Radioactive Wastes**
Low-level waste management, 6:33045
Pre- and post-dumping investigation for inauguration of new low-level radioactive waste dump sites, 6:33034
**Mill Tailings**
Engineering assessment of inactive uranium mill tailings, Shiprock site, Shiprock, New Mexico, 6:33026 (DOE/UMT—0104)
Stability of multilayer earthen barriers used to isolate mill tailings: geologic and geotechnological considerations, 6:33040 (PNL—3902)
Summary of the engineering assessment of inactive uranium mill tailings, Shiprock Site, Shiprock, New Mexico, 6:33027 (DOE/UMT—0104S)
**Physical Radiation Effects**
Structural damage from fission fragment irradiation in crystalline nuclear waste phases, 6:33022 (DOE/ET/41900—5)
**Public Opinion**
Public perceptions of industrial risks: the context of public attitudes toward radioactive waste, 6:33382 (PNL—3799)
**Radionuclide Migration**
Introduction to numerical modeling of thermohydrologic flow in fractured rock masses, 6:33048 (LBL—11566)
Predictive calculations of volatilities of metals and oxides in steam-containing environments, 6:33055 (UCRL—85553)
UK modelling of thermal effects on leakage from hard rock depositories, 6:33049 (LBL—11566)
**Site Selection**
Pre- and post-dumping investigation for inauguration of new low-level radioactive waste dump sites, 6:33034
**Temperature Effects**
Effects of annular air gaps surrounding an emplaced nuclear waste canister in deep geologic storage, 6:33044
**Temperature Gradients**
Possibility of multiple temperature maxima in geologic repositories for spent fuel from nuclear reactors, 6:33043
**Underground Disposal**
Hydrologic studies support, INTERCOMP code conversion. Annual report. Research report 80/15-44, 6:33023 (DOE/RL/10119—1)

**RADIOACTIVE WASTE FACILITIES**
**Hoists**
Seismic evaluation of the headframe structure and the cable/hoist system, 6:33032 (DPST—81-262)
**Seismic Effects**
Developing seismic design criteria, 6:33031 (DPST—81-262)
Earthquake engineering of large underground structures, 6:33033 (DPST—81-262)
Numerical modeling of earthquake effects on underground tunnels (Salt, granite, shale), 6:33030 (DPST—81-262)
Workshop on seismic performance of underground facilities, 6:33029 (DPST—81-262)

**RADIOACTIVE WASTE MANAGEMENT**
*See also RADIOACTIVE WASTE STORAGE*
Long-term toxicity reduction using an imploding liner reactor as a waste transmuter, 6:33067 (CONF-801011—(Vol.2))
**Low-Level Radioactive Wastes**
Low-level waste management, 6:33045
**Research Programs**
Technical progress report for the quarter, 1 January-31 March 1981, 6:33039 (ONWI—9-81-2)

**RADIOACTIVE WASTE PROCESSING**
**Containers**
Fracturing of simulated high-level waste glass in canisters, 6:33041 (PNL—3948)
**Cost**
Engineering assessment of inactive uranium mill tailings, Shiprock site, Shiprock, New Mexico, 6:33026 (DOE/UMT—0104)

Summary of the engineering assessment of inactive uranium mill tailings, Shiprock Site, Shiprock, New Mexico, 6:33027 (DOE/UMT—0104S)

**Solidification**

Fracturing of simulated high-level waste glass in canisters, 6:33041 (PNL—3948)

Storage and solidification of MAW/LAW in underground caverns (Phase 2). Studies on product conveyance in fall pipelines. Reporting period, July 1, 1979-December 31, 1979, 6:33020 (ORNL-tr—4777)

Structural damage from fission fragment irradiation in crystalline nuclear waste phases, 6:33022 (DOE/ET/41900—5)

**RADIOACTIVE WASTE STORAGE**

**Geologic Deposits**

Importance of creep failure of hard rock in the near field of a nuclear-waste repository, 6:33037 (LA-UR—81-2584)

**Temperature Effects**

Example of rock fracture characterization for modeling purposes, 6:33038 (LBL—11566)

**RADIOACTIVE WASTES**

*See also INTERMEDIATE-LEVEL RADIOACTIVE WASTES*
*RADIOACTIVE EFFLUENTS*

**Biodegradation**

Microbial transformation of low-level radioactive waste, 6:33795 (BNL—29762)

**Ground Disposal**

Soil homogeneity evaluation by radionuclide tracer breakthrough curve interpretation, 6:33819 (CONF-800433—)

**RADIOAUTOGRAPHY**

*See AUTORADIOGRAPHY*

**RADIOCARBON DATING**

*See ISOTOPE DATING*

**RADIOGRAPHS**

*See IMAGES*

**RADIOGRAPHY (AUTO)**

*See AUTORADIOGRAPHY*

**RADIOISOTOPE HEAT SOURCES**

**Fabrication**

$^{238}$Pu fuel form processes. Quarterly report, October-December 1980, 6:33070 (DPST—80-128-4)

**Impact Tests**

$^{238}$Pu fuel form processes. Quarterly report, October-December 1980, 6:33070 (DPST—80-128-4)

Space nuclear safety and fuels program. Progress report, 6:33071 (LA—8904-PR)

Space nuclear safety and fuels program. Progress report, April 1981, 6:33072 (LA—8968-PR)

**Nondestructive Testing**

Space nuclear safety and fuels program. Progress report, April 1981, 6:33072 (LA—8968-PR)

**RADIOISOTOPE MIGRATION**

*See RADIONUCLIDE MIGRATION*

**RADIOISOTOPES**

**Environmental Transport**

Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)

Environmental radionuclide concentrations: statistical model to determine uniformity of distribution, 6:33823 (CONF-800433—)

**Geochemistry**

Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)

**Market**

List of DOE radioisotope customers with summary of radioisotope shipments, FY 1980, 6:33068 (PNL—3839)

**Production**

List of DOE radioisotope customers with summary of radioisotope shipments, FY 1980, 6:33068 (PNL—3839)

**RADIONUCLIDE MIGRATION**

*(In environment.)*

**Thermoluminescent Dosimetry**

Environmental radiological survey of the intermediate-level waste system pipeline, 6:33803 (ORNL/TM—7858)

**Tracer Techniques**

Plutonium as a tracer for studies of settling processes in a slow body of running water, 6:33826 (CONF-800433—)

**RADIONUCLIDES**

*See RADIOISOTOPES*

**RADIOPHARMACEUTICALS**

**Chemical Properties**

Tricatecholamide analogs of enterobactin as gallium- and indium-binding radiopharmaceuticals, 6:33623

**Tissue Distribution**

Tricatecholamide analogs of enterobactin as gallium- and indium-binding radiopharmaceuticals, 6:33623

**RADIOPROTECTIVE SUBSTANCES**

**Radiosensitivity Effects**

Abstracts of twenty-ninth annual meeting of the Radiation Research Society, Minneapolis, Minnesota, 31 May-4 June 1981 (Lead abstract), 6:33897

**RADIOSENSITIZERS**

**Radiosensitivity Effects**

Abstracts of twenty-ninth annual meeting of the Radiation Research Society, Minneapolis, Minnesota, 31 May-4 June 1981 (Lead abstract), 6:33897

**RADON**

**Environmental Impacts**

Engineering assessment of inactive uranium mill tailings, Naturita Site, Naturita, Colorado, 6:33024 (DOE/UMT—012)

Engineering assessment of inactive uranium mill tailings, Shiprock site, Shiprock, New Mexico, 6:33026 (DOE/UMT—0104)

Summary of the engineering assessment of inactive uranium mill tailings, Naturita site, Naturita, Colorado, 6:33025 (DOE/UMT—012S)

Summary of the engineering assessment of inactive uranium mill tailings, Shiprock Site, Shiprock, New Mexico, 6:33027 (DOE/UMT—0104S)

**RAFT RIVER VALLEY**

**Geothermal Power Plants**

Semiannual progress report for the Idaho Geothermal Program, October 1, 1980 to March 31, 1981, 6:33225 (EGG—2110)

**RAILGUN ACCELERATORS**

**Operation**

Electromagnetic launcher: a new weapon, 6:33641 (UCRL—85877)

**Uses**

Electromagnetic launcher: a new weapon, 6:33641 (UCRL—85877)

**RAILROAD CARS**

**Unloading**

Coal handling in freezing weather present state-of-the-art and research needs, 6:32936 (EPRI-WS—79-236)

**RAIN**

*See also ACID RAIN*

**Modifications**

Studies at Plant Bowen: rainfall modification and wetfall chemistry, 6:33722 (ORNL/TM—7744)

**RAIN WATER**

**PIXE Analysis**

Element analysis by PIXE of environmental samples of the Brazilian Cerrado, 6:33813 (CONF-800433—)

**RANKINE CYCLE POWER SYSTEMS**

**Design**

Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 2. Final technical report, 6:33485 (DOE/CS/54224—T1-Vol.2)

**Economic Analysis**

Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 1. Executive summary, 6:33484 (DOE/CS/54224—T1-Vol.1)

Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 2. Final technical report, 6:33485 (DOE/CS/54224—T1-Vol.2)

**Environmental Impacts**
Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 2. Final technical report, 6:33485 (DOE/CS/54224—T1-Vol.2)
**Market**
Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 2. Final technical report, 6:33485 (DOE/CS/54224—T1-Vol.2)
**Performance**
Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 2. Final technical report, 6:33485 (DOE/CS/54224—T1-Vol.2)
**Technology Assessment**
Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 1. Executive summary, 6:33484 (DOE/CS/54224—T1-Vol.1)

**RARE EARTH COMPOUNDS**
**Electric Conductivity**
Some thermoelectric properties of the light rare earth sesquiselenides ($R_2Se_{3-x}$), 6:33559 (IS-M—329)
**Thermoelectric Properties**
Some thermoelectric properties of the light rare earth sesquiselenides ($R_2Se_{3-x}$), 6:33559 (IS-M—329)

**RARE EARTHS**
*See also CERIUM*
*ERBIUM*
*EUROPIUM*
*GADOLINIUM*
*HOLMIUM*
*LANTHANUM*
*LUTETIUM*
*NEODYMIUM*
*PRASEODYMIUM*
*SAMARIUM*
*TERBIUM*
*THULIUM*
*YTTERBIUM*
**Chemistry**
Low-energy nuclear sciences, 6:33620 (LBL—12000)

**RATE STRUCTURE**
**Public Relations**
Energy management programs for commercial & industrial customers: panel presentation, 6:33431

**RATS**
**Biological Stress**
In vivo metabolism of a new class of biologically active phospholipids: 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine, a platelet activating-hypotensive phospholipid, 6:33864

**RDF**
*See REFUSE DERIVED FUELS*

**REACTOR ACCIDENTS**
*See also FUEL ELEMENT FAILURE*
*LOSS OF COOLANT*
*LOSS OF FLOW*
*MELTDOWN*
*REACTOR CORE DISRUPTION*
*TRANSIENT OVERPOWER ACCIDENTS*
**Emergency Plans**
Application of MORT analysis to emergency preparedness for nuclear power stations (Management Oversight and Risk Tree approach), 6:33362 (PNL-SA—9316)

**REACTOR COMPONENTS**
*See also BREEDING BLANKETS*
**Defects**
Engineering approach for elastic-plastic fracture analysis, 6:33510 (EPRI-NP—1931)
**Welded Joints**
Finite element analysis of the stress intensity factors of cracks in welded transition joints, 6:33327 (R/M/R—263)

**REACTOR CONTROL SYSTEMS**
*(The processes and operations ensuring the control and safe running of a nuclear reactor.)*
**Display Devices**
Janus displays for improved reactor plant operation and control, 6:33331 (CONF-810606—71)

**REACTOR CONTROL THEORY**
*See REACTOR KINETICS*

**REACTOR CORE DISRUPTION**
**Bubbles**
General formulation of an HCDA bubble rising in a sodium pool and the effect of nonequilibrium on fuel transport, 6:33344 (DOE/ET/37227—T1)
**Hydraulics**
Experimental studies in CDA work-energy attenuation. Quarterly technical progress report No. 22, 1 April- 30 June 1980 (LMFBR), 6:33347 (DOE/SF/70097—T8)

**REACTOR FUELS**
*See NUCLEAR FUELS*

**REACTOR INSTRUMENTATION**
**Calibration**
Optimal calibration of nuclear instrumentation, 6:33332 (CONF-810606—72)

**REACTOR KINETICS**
Manual for use with the computer code SUPERENERGY: data reduction version (LMFBR), 6:33304 (DOE/ET/37240—74TR)

**REACTOR MATERIALS**
*(See also specific materials.)*
*See also MATRIX MATERIALS*
*NUCLEAR FUELS*
**Creep**
Finite-element program for creep analysis of concrete structures, 6:33556 (CONF-810801—57)
**Decomposition**
Analysis of potential attack on insulating materials exposed to sodium. Final report (LMFBR), 6:33306 (EPRI-NP—1986)
**Fatigue**
Designing against low-cycle fatigue at elevated temperature, 6:33315
**Fracture Properties**
Engineering approach for elastic-plastic fracture analysis, 6:33510 (EPRI-NP—1931)
Structural Mechanics Program: progress in 1980, 6:33289 (EPRI-NP—1969-SR)
**Physical Radiation Effects**
Structural Mechanics Program: progress in 1980, 6:33289 (EPRI-NP—1969-SR)
**Stress Corrosion**
Structural Mechanics Program: progress in 1980, 6:33289 (EPRI-NP—1969-SR)

**REACTOR SITING**
*See SITE SELECTION*

**REAL TIME SYSTEMS**
**Data Processing**
Efficient methods for calculating the success function of fixed-space replacement policies, 6:34193 (LBL—12370)

**RECEIVERS (SOLAR)**
*See SOLAR RECEIVERS*

**RECYCLE (FUEL)**
*See FUEL CYCLE*

**RECYCLING (FUEL)**
*See REPROCESSING*

**REDOX FUEL CELLS**
**Electrodes**
Preparation and characterization of electrodes for the NASA Redox storage system (Iron and chromium chloride reactants), 6:33441 (DOE/NASA/12726—13)

**REFINERY GASES**
**Cocombustion**
Feasibility and economic study of medium-Btu coal gas blended with high-Btu by-product gas as an industrial energy source at Billings, Montana. Final report, 6:33082 (DOE/FE/20219—2)

**REFLECTIVITY**
**Goniometers**
Experimental design for reflection measurements of highly reactive liquid or solid substances with application to liquid sodium, 6:33345 (DOE/ET/37227—T2)

**REFRACTORIES**
**Erosion**
Design of refractories for resistance to high-temperature erosion-corrosion. Final report, 6:33547 (EPRI-AP—1955)

**REFUSE**
*See SOLID WASTES*

**REFUSE DERIVED FUELS**
*See also MUNICIPAL WASTES*
*SOLID WASTES*
*SYNTHETIC FUELS*
**Cocombustion**
Cofiring of refuse-derived fuel and coal at Oak Creek. Volume 1. Boiler corrosion evaluation. Final report, 6:33088 (EPRI-CS—1983-Vol.1)
**REFUSE-FUELED BOILERS**
**Corrosion**
Cofiring of refuse-derived fuel and coal at Oak Creek. Volume 1. Boiler corrosion evaluation. Final report, 6:33088 (EPRI-CS—1983-Vol.1)
**REGENERATIVE FUEL CELLS**
*See also REDOX FUEL CELLS*
**Reviews**
Review of thermally regenerative electrochemical systems, 6:33442 (SERI/TR—332-416-Vol.2)
**REGION V**
*See GREAT LAKES REGION*
**REGION VII**
*See MIDWEST REGION*
**REGION X**
*See PACIFIC NORTHWEST REGION*
**RELATIVISTIC BEAM INJECTION**
Radiation source (Patent), 6:34191
**RENEWABLE ENERGY SOURCES**
*See also BIOMASS*
*GEOTHERMAL ENERGY*
*SOLAR ENERGY*
*WIND POWER*
**Meetings**
Proceedings of the Pacific Northwest alternative and renewable energy resources conference, 6:33432 (CONF-7910232—)
**REPROCESSING**
APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste, 6:33318 (BNL—29899)
**RESEARCH PROGRAMS**
**Comparative Evaluations**
Sensitivity analysis of project appraisal variables. Volume II. Additional variables and composite scenarios, 6:33405 (DOE/ET/15078—T9)
**Decision Making**
Application of an LP model to strategic planning of multinational cooperative RD and D programs (MARKAL), 6:33387 (BNL—29857)
**RESIDENTIAL BUILDINGS**
*See also APARTMENT BUILDINGS*
*HOUSES*
**Cold Storage**
Thermal-energy-storage devices, 6:33461
**Energy Conservation**
Energy conservation and the rental housing market, 6:33396
**Energy Efficiency**
Technology change and energy consumption: a comparison of residential subdivisions, 6:33460 (PNL-SA—9049)
**Heat Storage**
Thermal-energy-storage devices, 6:33461
**Photovoltaic Power Supplies**
Integrated residential photovoltaic array development. Quarterly report No. 2, 6:33125 (DOE/JPL/955894—2)
**Solar Air Conditioning**
Institutional analysis of solar heating and cooling of housing: summary report, 6:33101 (MIT-EL—79-044)
Solar heating and cooling of housing: five institutional analysis case studies, 6:33100 (MIT-EL—79-030)
**Solar Space Heating**
Institutional analysis of solar heating and cooling of housing: summary report, 6:33101 (MIT-EL—79-044)
Solar heating and cooling of housing: five institutional analysis case studies, 6:33100 (MIT-EL—79-030)
**RESIDENTIAL SECTOR**
**Energy Consumption**
Technology change and energy consumption: a comparison of residential subdivisions, 6:33460 (PNL-SA—9049)
**Solar Energy**
Solar energy for California's residential sector: progress, problems, and prospects, 6:33104
**RESIDUAL FUELS**
**Combustion**
Design and preliminary results of a fuel flexible industrial gas turbine combustor, 6:32950
Evaluation of concepts for controlling exhaust emissions from minimally processed petroleum and synthetic fuels, 6:32953
Low NO/sub x/ combustion systems for burning heavy residual fuels and high-fuel-bound nitrogen fuels, 6:32951
**RESIDUES**
*See also ASHES*
**Gasification**
Ash concentrate conveying system, 6:32822 (DOE/OR/03054—3)
**Pneumatic Transport**
Ash concentrate conveying system, 6:32822 (DOE/OR/03054—3)
**RESIDUES (RADIOACTIVE)**
*See RADIOACTIVE WASTES*
**RESINS**
**Decomposition**
Electrical conductivity and thermal decomposition of high temperature phenolic- and silicone-based materials, 6:33552 (SAND—81-0786C)
**Electric Conductivity**
Electrical conductivity and thermal decomposition of high temperature phenolic- and silicone-based materials, 6:33552 (SAND—81-0786C)
**RESOURCE ASSESSMENT**
**Mathematical Models**
Comparative study of wind characteristics from different time periods, 6:33244
Comparison of height extrapolation models and sensitivity analysis, 6:33236
Estimation of the parameters of the distribution of wind speed and direction, 6:33250
Simple model for the probability distribution of wind power with applications to large scale electricity generation, 6:33246
**RESOURCE DEVELOPMENT**
**Legal Aspects**
Contracts or concessions for exploration and production, 6:33411 (EPRI-WS—79-182)
**Political Aspects**
Effect of the prospective investment climate on future oil and gas supplies from foreign sources, 6:33410 (EPRI-WS—79-182)
Impact of economic and demographic growth on oil and gas availability from less developed countries, 6:33408 (EPRI-WS—79-182)
**Socio-Economic Factors**
Mexico's oil and gas: a realistic perspective, 6:33417 (EPRI-WS—79-182)
**Subsidies**
Effect of the prospective investment climate on future oil and gas supplies from foreign sources, 6:33410 (EPRI-WS—79-182)
**RESOURCE RECOVERY FACILITIES**
**Economic Analysis**
Opelika resource recovery project: report on the technological and economic evaluation, 6:33475 (DOE/CS/20243—1)
**Feasibility Studies**
Potential for resource recovery from municipal solid waste in Warren County, Tennessee, 6:33480 (TVA/OP/EDT—81/39)
**Operation**
Potential opportunities for revitalization of the Rochester, New York steam district heating system, 6:33479 (ORNL/TM—7757)
**Particle Size Classifiers**
Review of the literature on the use of trommels in waste processing and resource recovery, 6:33474 (DOE/CS/20167—6)
**Pollution Control**
Pollution control for a multi-fuel burning facility, 6:33482
**Technology Assessment**
Opelika resource recovery project: report on the technological and economic evaluation, 6:33475 (DOE/CS/20243—1)

**RESPIRATORS**
**Performance Testing**
Respirator canister testing for radioiodine, 6:33644
**RESPIRATORY EQUIPMENT**
*See RESPIRATORS*
**RETORTED SHALES**
*See SPENT SHALES*
**REVERSE-FIELD PINCH**
**Design**
Design studies of commercial magnetic fusion reactors, 6:34170 (CONF-801011—(Vol.3))
Production of substitute natural gas by a fusion hybrid reactor coupled to a catalyzed coal gasification plant, 6:34125 (CONF-801011—(Vol.2))
**Energy Losses**
Ideal mhd stable startup and burn for the reversed field pinch, 6:34054 (CONF-801011—(Vol.3))
**Magnetic Field Configurations**
Technology issues of tract plasma engineering, 6:34084 (CONF-801011—(Vol.1))
**Reactor Start-Up**
Ideal mhd stable startup and burn for the reversed field pinch, 6:34054 (CONF-801011—(Vol.3))
**REVERSIBLE TURBINES**
*See PUMP TURBINES*
**RHENIUM ALLOYS**
**Blisters**
Surface radiation damage in molybdenum alloys irradiated, 6:34127 (CONF-801011—(Vol.2))
**RHODAMINES**
**Fluorescence Spectroscopy**
Two-laser induced selective infrared-visible fluorescence for thin film analysis, 6:33584
**Laser Spectroscopy**
Two-laser induced selective infrared-visible fluorescence for thin film analysis, 6:33584
**RHODE ISLAND**
**Coal Deposits**
Exploration of coal and anthracitic carbonaceous shale resources, Narragansett Basin, Massachusetts and Rhode Island. Final report, 1 October 1979-30 April 1981, 6:32899 (DOE/RA/20029—T1)
**Coal Mining**
Exploration of coal and anthracitic carbonaceous shale resources, Narragansett Basin, Massachusetts and Rhode Island. Final report, 1 October 1979-30 April 1981, 6:32899 (DOE/RA/20029—T1)
**RICHLAND FFTF REACTOR**
*See FFTF REACTOR*
**RIO GRANDE RIFT**
**Geophysical Surveys**
Comparative assessment of five potential sites for magma: hydrothermal systems - geophysics, 6:33221 (UCRL—52980)
**Resource Assessment**
Comparative assessment of five potential sites for magma: hydrothermal systems - geophysics, 6:33221 (UCRL—52980)
**RISER CRACKING**
*See COAL LIQUEFACTION*
**RIVERS**
*See also STREAMS*
**Sampling**
Approach to Cadmium speciation in natural waters using $^{109}Cd$ as radiotracer, 6:33818 (CONF-800433—)
**Sediments**
Non-destructive multi-element photon activation analysis of river sediments, 6:33810 (CONF-800433—)
**Water Quality**
Neutron activation analysis in the survey of river water quality and trace element distribution, 6:33812 (CONF-800433—)
**ROCK CAVERNS**
**Compressed Air Energy Storage**
Reservoir stability studies, 6:33370 (PNL-SA—9782)
**ROCK MECHANICS**
**Flow Models**
Program ROCMAS: introduction and user's guide, 6:33931 (LBL—12987)
**ROCKS**
**Fluid Flow**
Finite element method for coupled stress and fluid flow analysis of fractured rock masses, 6:33929 (LBL—11566)
Modeling of groundwater flow in fractured rocks for radioactive waste repository studies, 6:33928 (LBL—11566)
**Mechanical Properties**
Analysis of factors influencing roof stability at Wallsend Borehole Colliery, 6:32918
Method of investigations, estimation, and classification of roofs in mines in the United States of America for the selection of suitable mechanized support for longwalls. Report No. 1: January 1, 1977-March 31, 1977, 6:32910 (DOE/TIC—11477)
**Radionuclide Migration**
Introduction to numerical modeling of thermohydrologic flow in fractured rock masses, 6:33048 (LBL—11566)
UK modelling of thermal effects on leakage from hard rock depositories, 6:33049 (LBL—11566)
**Thermal Stresses**
Finite element method for coupled stress and fluid flow analysis of fractured rock masses, 6:33929 (LBL—11566)
Porous media fluid flow, heat, and mass transport model with rock stress coupling, 6:33052 (LBL—11566)
UK modelling of thermal effects on leakage from hard rock depositories, 6:33049 (LBL—11566)
**ROCKY FLATS PLANT**
**Radiation Accidents**
Probabilities of aircraft crashes at Rocky Flats and subsequent radioactive releases, 6:33768 (RFP—2462-Add.)
**ROOFS**
**Compression Strength**
Application of a roof bolt hole penetrometer to the determination of in situ strength of coal-measure sediments, 6:32917
**Deformation**
Analysis of factors influencing roof stability at Wallsend Borehole Colliery, 6:32918
**Stability**
Analysis of factors influencing roof stability at Wallsend Borehole Colliery, 6:32918
**Stresses**
Stress measurement on the Wambo colliery holding and their interpretation in terms of roof conditions, 6:32920
**ROOSEVELT HOT SPRINGS**
**Geophysical Surveys**
Comparative assessment of five potential sites for magma: hydrothermal systems - geophysics, 6:33221 (UCRL—52980)
**Resource Assessment**
Comparative assessment of five potential sites for magma: hydrothermal systems - geophysics, 6:33221 (UCRL—52980)
**ROTARY DRILLS**
*See also DRILL BITS*
**Materials Handling**
Development of two-phase flow and material-transport models for large-diameter drilling systems: program overview and preliminary results, 6:33636 (LA—8894-MS)
**Two-Phase Flow**
Development of two-phase flow and material-transport models for large-diameter drilling systems: program overview and preliminary results, 6:33636 (LA—8894-MS)
**ROUS SARCOMA VIRUS**
*See ONCOGENIC VIRUSES*
**RUBIDIUM**
**Mass Spectroscopy**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
**RURAL AREAS**
**Power Demand**
ORNL rural electric-energy-demand forecasting model, 6:33427 (ORNL/TM—7863)
**RUTHENIUM**
**Solvent Extraction**
Solvent extraction behavior of ruthenium I. The nitric acid-tri-n-butyl phosphate system, 6:33586

**RUTHENIUM COMPLEXES**
**Chemical Reactions**
Mechanistic studies of carbon monoxide reduction. Progress report, August 1, 1980-August 1, 1981, 6:33080 (DOE/ER/10345—2)
**Structural Chemical Analysis**
Mechanistic studies of carbon monoxide reduction. Progress report, August 1, 1980-August 1, 1981, 6:33080 (DOE/ER/10345—2)

## S

**SACCHAROMYCES CEREVISIAE**
**Gene Recombination**
Spontaneous mitotic recombination in mms8-1, an allele of the CDC9 gene of Saccharomyces cerevisiae, 6:33873
**SAFEGUARDS**
Findings supporting determination related to international nuclear power export activities pending preparation of a section 102(2)(C) NEPA environmental statement, 6:33290 (ERDA—80)
**SAFETY (NUCLEAR)**
*See RADIATION PROTECTION*
**SAFETY STANDARDS**
**Recommendations**
Report of the control technology session of the workshop on indoor air quality research needs, 6:33741 (CONF-801259—)
**SALT CAVERNS**
**Compressed Air Energy Storage**
Reservoir stability studies, 6:33370 (PNL-SA—9782)
**Depressurization**
Microseismic activity observed during depressurization of an oil storage cavern in rock salt, 6:32987 (LA-UR—81-2622)
**Seismic Detection**
Microseismic activity observed during depressurization of an oil storage cavern in rock salt, 6:32987 (LA-UR—81-2622)
**SALT DEPOSITS**
**Sorptive Properties**
Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)
**SALTON SEA GEOTHERMAL FIELD**
**Geophysical Surveys**
Comparative assessment of five potential sites for magma: hydrothermal systems - geophysics, 6:33221 (UCRL—52980)
**Resource Assessment**
Comparative assessment of five potential sites for magma: hydrothermal systems - geophysics, 6:33221 (UCRL—52980)
**SALTS**
**Optical Properties**
Optical transparency of inexpensive salt solutions for construction of density-gradient ponds, 6:33199 (SERI/RR—641-615)
**SAMARIUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Neutron Reactions**
Experimental determination of anomalous scattering lengths of samarium for thermal neutrons, 6:34018 (BNL—29949)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**SAMARIUM 144 TARGET**
**Krypton 86 Reactions**
Gamma-ray multiplicity moments from $^{86}$Kr reactions on $^{144}$sup(,)$^{154}$Sm at 490 MeV, 6:34016
**SAMARIUM 152 TARGET**
**Oxygen 16 Reactions**
Multiple Coulomb polarization potential for heavy ion scattering, 6:34025
**SAMARIUM 154 TARGET**
**Krypton 86 Reactions**
Gamma-ray multiplicity moments from $^{86}$Kr reactions on $^{144}$sup(,)$^{154}$Sm at 490 MeV, 6:34016
**SAMPLE CHANGERS**
**Automation**
Automation of a specimen stage in an electron microprobe. Final report, 6:33696 (BDX—613-2668)
**SAMPLE PREPARATION**
**Biological Effects**
Retention of metabolized trace elements in rat tissues: silver, cerium, caesium, manganese, scandium and tin, 6:33845 (CONF-800433—)
**SAMPLING**
**Statistics**
Problems associated with approximating distributions, 6:34199
**SAND**
**Permeability**
Effects of confining pressure, pore pressure and temperature on absolute permeability. SUPRI TR-27, 6:32986 (DOE/ET/12056—27)
**SANDIA LABORATORIES**
**Darrieus Rotors**
Wind turbine, 6:33247
**SANDSTONES**
**Permeability**
Effects of confining pressure, pore pressure and temperature on absolute permeability. SUPRI TR-27, 6:32986 (DOE/ET/12056—27)
**SANITARY LANDFILLS**
**Constraints**
Ash disposal methods: Eastern and Western coal (In Wisconsin), 6:32876 (EPRI-WS—79-236)
**SATELLITE POWER SYSTEM**
*See ORBITAL SOLAR POWER PLANTS*
**SATELLITE SOLAR POWER STATIONS**
*See ORBITAL SOLAR POWER PLANTS*
**SAVANNAH RIVER PLANT**
**Environmental Effects**
Environmental monitoring in the vicinity of the Savannah River Plant. Annual report, 1980, 6:33801 (DPSPU—81-30-1)
**Radiation Monitoring**
Environmental monitoring in the vicinity of the Savannah River Plant. Annual report, 1980, 6:33801 (DPSPU—81-30-1)
**SCANDIUM**
**Ductility**
Mechanical properties and hydrogen embrittlement of scandium, 6:33519 (IS-T—918)
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Hydrogen Embrittlement**
Mechanical properties and hydrogen embrittlement of scandium, 6:33519 (IS-T—918)

**SCHOOL BUILDINGS**
**Geothermal Water Heating**
New Mexico State University campus geothermal demonstration project: an engineering construction design and economic evaluation. Final technical report, February 25, 1980-April 24, 1981, 6:33233
**Solar Space Heating**
Solar heating and hot water system installed at James Hurst Elementary School, Portsmouth, VA. Final Report, 6:33164 (DOE/NASA/CR—161830)
**Solar Water Heating**
Solar heating and hot water system installed at James Hurst Elementary School, Portsmouth, VA. Final Report, 6:33164 (DOE/NASA/CR—161830)
**SCREENS**
**Test Facilities**
Fossil-energy program. Progress report for July 1981, 6:32803 (ORNL/TM—7960)
**SCREW INSTABILITY**
*See HELICAL INSTABILITY*
**SCRUBBERS**
**Sludges**
Ash disposal methods: Eastern and Western coal, 6:32876 (EPRI-WS—79-236)
**SEA DISPOSAL**
*See MARINE DISPOSAL*
**SEALS**
**Performance Testing**
Cryogenic pressure testing of demountable seals for large-coil program applications, 6:33633 (CONF-810835—12)
**SEAWATER**
**Activation Analysis**
Study of heavy elements (Cd, Hg and Se) in the aquatic environment around Bombay by radiochemical neutron activation analysis, 6:33814 (CONF-800433—)
**Chemistry**
Ocean Thermal Energy Conversion (OTEC) Programmatic Environmental Analysis. Volume 2. Appendices, 6:33153 (LBL—10511-Vol.2)
**Degassing**
Ocean thermal energy conversion gas-desorption studies. Volume 2. Deaeration in a packed column and a barometric intake system, 6:33156 (ORNL/TM—7438-Vol.2)
**Multi-Element Analysis**
Study of heavy elements (Cd, Hg and Se) in the aquatic environment around Bombay by radiochemical neutron activation analysis, 6:33814 (CONF-800433—)
**SEDIMENTS**
**Activation Analysis**
Non-destructive multi-element photon activation analysis of river sediments, 6:33810 (CONF-800433—)
Study of heavy elements (Cd, Hg and Se) in the aquatic environment around Bombay by radiochemical neutron activation analysis, 6:33814 (CONF-800433—)
**Chemical Analysis**
Resource characterization for uranium mineralization in the Montrose $1^0$ x $2^0$ quadrangle, Colorado, 6:33015 (LA-UR—81-2451)
**Geochemistry**
Stream sediment detailed geochemical survey for Date Creek Basin, Arizona, 6:33006 (GJBX—243-81)
**Multi-Element Analysis**
Non-destructive multi-element photon activation analysis of river sediments, 6:33810 (CONF-800433—)
Study of heavy elements (Cd, Hg and Se) in the aquatic environment around Bombay by radiochemical neutron activation analysis, 6:33814 (CONF-800433—)
**Radioactivity**
Environmental concentration and migration of $^{129}I$, 6:33767 (PNL-SA—9140)
**Radionuclide Migration**
Model for Pb-210 in sediments influenced by mixing and compaction, 6:33796 (CONF-800433—)
**SEISMIC EFFECTS**
**Meetings**
Workshop on seismic performance of underground facilities, 6:33029 (DPST—81-262)
**SEISMIC NOISE**
**Monitoring**
Microseismic monitoring at 53 Level, West No. 2 mine, Collinsville: a feasibility study, 6:32919
**SEISMIC WAVES**
Computation of seismic wave fields and soil-structure interaction, 6:33927 (DPST—81-262)
**SELENIDES**
**Electric Conductivity**
Some thermoelectric properties of the light rare earth sesquiselenides ($R_2Se$/sub 3-x/), 6:33559 (IS-M—329)
**Thermoelectric Properties**
Some thermoelectric properties of the light rare earth sesquiselenides ($R_2Se$/sub 3-x/), 6:33559 (IS-M—329)
**SELENIUM**
**Absorption Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Ecological Concentration**
Study of heavy elements (Cd, Hg and Se) in the aquatic environment around Bombay by radiochemical neutron activation analysis, 6:33814 (CONF-800433—)
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
**SELF-SERVE STATIONS**
*See GASOLINE SERVICE STATIONS*
**SEMICONDUCTOR DEVICES**
**Fabrication**
Coherent multilayer crystals and method of making (Patent), 6:33566
**SENIOR CENTERS**
*See PUBLIC BUILDINGS*
**SENSIBLE HEAT STORAGE**
**Mathematical Models**
Review of simulation techniques for aquifer thermal energy storage (ATES), 6:33375 (PNL—3769)
**SERUM (BLOOD)**
*See BLOOD SERUM*
**SERVICE STATIONS**
*See GASOLINE SERVICE STATIONS*
**SEWAGE**
**Activation Analysis**
Multielement analysis of soil of a sewage-farm by photon and neutron activation analysis using waste incineration ash as reference material, 6:33786 (CONF-800433—)
**Multi-Element Analysis**
Multielement analysis of soil of a sewage-farm by photon and neutron activation analysis using waste incineration ash as reference material, 6:33786 (CONF-800433—)
**SEWAGE SLUDGE**
**Anaerobic Digestion**
Bioconversion energy systems: new developments and opportunities, 6:33085
Kinetics of acid-phase fermentation in anaerobic digestion, 6:33086
**Incinerators**
Demonstration of waste-sludge incinerator fuel reduction: pilot project report, 6:33476 (DOE/CS/20321—1)
**Multi-Element Analysis**
Application of neutron activation analysis in a regulatory agency, 6:33883 (CONF-800433—)
**SEWAGE TREATMENT**
*See WASTE PROCESSING*
**SHALE OIL**
**Comparative Evaluations**
Economics of enhanced oil recovery and its position relative to synfuels, 6:32976

**Marketing**
Transportation and marketing plan, 6:32996 (DOE/SF/10852—T1)
**Supply and Demand**
Basic facts about Colorado's energy resources and reserves, 6:33386
**Transport**
Transportation and marketing plan, 6:32996 (DOE/SF/10852—T1)
**SHEARER LOADERS**
**Dusts**
Mine demonstrations of longwall dust control techniques. Technical status report, July 31, 1981-August 31, 1981, 6:32908 (DOE/ET/12532—T4)
**SHEATHS (FUEL)**
*See FUEL CANS*
**SHIELDING**
**Neutron Reactions**
Blanket and shield nucleonic considerations for the Field-Reversed Mirror Small Reactor, 6:34093 (CONF-801011—(Vol.1))
**Optimization**
Importance of shield design in minimizing radioactive material inventory in tokamaks, 6:34094 (CONF-801011—(Vol.1))
**SHIELDING MATERIALS**
Shielding for TFTR, 6:34158 (CONF-801011—(Vol.3))
**Detection**
Evaluation of active and passive near-millimeter-wave radiometric imaging techniques for detection of concealed objects, 6:33062 (SAND—81-1051)
**SHIPS**
**Diesel Engines**
Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 1. Executive summary, 6:33484 (DOE/CS/54224—T1-Vol.1)
Study of the validation of the application of Rankine Bottoming Cycle technology to marine diesel engines. Volume 2. Final technical report, 6:33485 (DOE/CS/54224—T1-Vol.2)
**Fuels**
Evaluation of the alternatives for contingency fuels in the commercial marine-transportation industry, 6:33462 (DOE/CS/51175—T18)
**SHRIMP**
**Survival Time**
Studies on toxicity of OTEC plant components on marine animals from the Gulf of Mexico. Final report, September 1, 1978-November 30, 1980, 6:33909 (DOE/ET/20512—T1)
**SILICA**
**Catalytic Effects**
Exploratory study of coal-conversion chemistry. Quarterly report No. 9, March 20, 1980-June 19, 1980, 6:32816 (DOE/ET/14855—9)
Exploratory study of coal-conversion chemistry. Quarterly report, December 20, 1979-March 19, 1980, 6:32815 (DOE/ET/14855—6)
**SILICATES**
**Catalytic Effects**
Surface science of heterogeneous catalysis: possible applications in atmospheric sciences, 6:33590 (LBL—12986)
**SILICON**
**Crystal Defects**
Electrical property studies of oxygen in Czochralski-grown neutron-transmutation-doped silicon, 6:34047 (CONF-800877—3)
**Crystal Growth**
Development of advanced Czochralski growth process to produce low-cost 150-kG silicon ingots from a single crucible for technology readiness. Second quarterly progress report, January 1-March 31, 1981, 6:33112 (DOE/JPL/955733—T1)
Large area silicon sheet by EFG. Second quarterly report, April 1, 1981-June 30, 1981, 6:33110 (DOE/JPL/954355—81-18)
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Environmental Impacts**
Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**Health Hazards**
Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**Physical Radiation Effects**
Electrical property studies of oxygen in Czochralski-grown neutron-transmutation-doped silicon, 6:34047 (CONF-800877—3)
Threshold voltage for damage in Si under electron bombardment (200 kV), 6:33568
**Production**
Large area silicon sheet by EFG. Second quarterly report, April 1, 1981-June 30, 1981, 6:33110 (DOE/JPL/954355—81-18)
Low-cost solar-array project: experimental process system development unit for producing semiconductor-grade silicon using the silane-to-silicon process. Quarterly progress report, April-June 1981, 6:33109 (DOE/JPL/954334—19)
**Protective Coatings**
Photoelectrochemical solar cells: stabilization of small-band-gap semiconductor in aqueous solution by surface-attached organic conducting polymer, 6:33120 (SERI/TP—233-1388)
**Tissue Distribution**
Feasibility study for the in vivo measurement of silicon and beryllium by nuclear techniques, 6:33868 (CONF-800433—)
**SILICON 28 REACTIONS**
**Elastic Scattering**
High spin resonances in $^{28}Si + ^{28}Si$ scattering, 6:34011
**Inelastic Scattering**
High spin resonances in $^{28}Si + ^{28}Si$ scattering, 6:34011
**SILICON 28 TARGET**
**Silicon 28 Reactions**
High spin resonances in $^{28}Si + ^{28}Si$ scattering, 6:34011
**SILICON 29**
**Oxygen 18 Reactions**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**SILICON 29 TARGET**
**Electron Reactions**
Nuclear structure studies by the scattering of medium-energy electrons. Progress report, October 1, 1980-July 31, 1981, 6:34000 (DOE/ER/02853—T1)
**SILICON OXIDES**
*See also QUARTZ*
**Thermal Conductivity**
Thermal conductivity measurements of insulators for fusion blankets, 6:33498 (BNL—29779)

**SILICON SOLAR CELLS**
**Amorphous State**
Amorphous boron-silicon-hydrogen alloys for thin-film heterojunction solar cells. Quarterly technical progress report No. 2, 1 September 1980-30 November 1980, 6:33117 (SERI/PR—0-9010-2)
**Efficiency**
Amorphous boron-silicon-hydrogen alloys for thin-film heterojunction solar cells. Quarterly technical progress report No. 3, 1 December 1980-28 February 1981, 6:33118 (SERI/PR—0-9010-3)
Effect of zinc impurity on silicon solar-cell efficiency, 6:33123
**Electrical Properties**
Use of V/sub OC//J/suc SC/ measurements for determination of barrier height under illumination and for fill-factor calculations in Schottky-barrier solar cells, 6:33565
**Environmental Impacts**
Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**Fabrication**
Silicon solar cell process development, fabrication, and analysis. Ninth quarterly report, 1 January 1981-31 March 1981, 6:33111 (DOE/JPL/955089—81/11)
**Health Hazards**
Social cost factors and the development of photovoltaic energy systems, 6:33127 (MIT-EL—79-026)
**Heterojunctions**
Amorphous boron-silicon-hydrogen alloys for thin-film heterojunction solar cells. Quarterly technical progress report No. 2, 1 September 1980-30 November 1980, 6:33117 (SERI/PR—0-9010-2)
**Mathematical Models**
Thin-film polycrystalline-silicon solar cells. Quarterly report No. 1, January 1-March 31, 1979, 6:33107 (DOE/ET/23047—T2)
**Performance Testing**
Silicon solar cell process development, fabrication, and analysis. Ninth quarterly report, 1 January 1981-31 March 1981, 6:33111 (DOE/JPL/955089—81/11)
**SILICONES**
**Decomposition**
High temperature electrical conductivity and thermal decomposition of phenolic- and silicon-based dielectrics for fireset housings, 6:33560 (SAND—81-0786)
**Electric Conductivity**
High temperature electrical conductivity and thermal decomposition of phenolic- and silicon-based dielectrics for fireset housings, 6:33560 (SAND—81-0786)
**Stress Relaxation**
Stress relaxation of cellular silicone material: 1981, 6:33555 (BDX—613-2645)
**SILVER**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Mass Spectroscopy**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
**Measuring Methods**
Neutron activation analysis of copper and silver in environmental samples, 6:33736 (CONF-800433—)
**Voltametry**
Precious metal analysis by controlled potential coulometry, 6:33583
**SILVER SELENIDES**
**Electric Conductivity**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**Fabrication**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**Tensile Properties**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**Thermal Conductivity**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**SITE SELECTION**
**Comparative Evaluations**
Site confirmation study, 6:32824 (DOE/OR/03054—3)
**SKELETON**
**Radiation Scattering Analysis**
Evaluation of the diagnostic sensitivity of scattering measurements of bone density, 6:33869 (CONF-800433—)
**SLAGS**
**Viscosity**
High-mass-flux coal gasifier. Final report, Phase III (Bill high mom flux), 6:32812 (DOE/ET/14674—16)
**SLOPE STABILITY**
**Data Analysis**
Two-wedge stability analysis based on energy principles, 6:32913
**Monitoring**
Study of the instability of a spoil pile in an open strip coal mine, 6:32912
**SLOT OVENS**
*See COKE OVENS*
**SLUDGES**
**Ground Disposal**
Monitoring the fixed FGD sludge landfill, Conesville, Ohio. Phase II, 6:32869 (EPRI-CS—1984)
**Marine Disposal**
Coal waste artificial reef program, Phase 3. Volume 3. Engineering-economic evaluation of fixed coal waste block production and disposal. Final report, 6:32870 (EPRI-CS—2009(Vol.3))
**Solidification**
Monitoring the fixed FGD sludge landfill, Conesville, Ohio. Phase II, 6:32869 (EPRI-CS—1984)
**Waste Disposal**
Ash disposal methods: Eastern and Western coal, 6:32876 (EPRI-WS—79-236)
Solid-waste impacts of increased coal utilization, 6:32865 (BNL—24786)
**SLURRIES (FUEL)**
*See FUEL SLURRIES*
**SMALL-SCALE HYDROELECTRIC POWER PLANTS**
**Economic Analysis**
Micro-hydropower in the United States, 6:33089 (EGG-M—02781)
**Feasibility Studies**
Micro-hydropower in the United States, 6:33089 (EGG-M—02781)
**Institutional Factors**
Micro-hydropower in the United States, 6:33089 (EGG-M—02781)
**SNEAK REACTOR**
**Reactor Kinetics**
ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)

**SNOW**
**Buildup**
Anomalous snowfall caused by natural-draft cooling towers, 6:33723 (ORNL/TM—7744)
**SOCIO-ECONOMIC FACTORS**
Nuclear energy center conceptual study. Phase III: site specific evaluation. Topical report, environmental, 6:33335 (DOE/OR/06074—1-Vol.3)
**SODIUM**
**Chemical Bonds**
Model compound study of the mechanism of $sp^2$-$sp^3$ carbon-carbon cleavage during the reduction of coals (Bibenzyl, diphenylmethane, α-benzylnaphthalene), 6:33606 (CONF-810914—4)
**Chemical Reaction Kinetics**
Model compound study of the mechanism of $sp^2$-$sp^3$ carbon-carbon cleavage during the reduction of coals (Bibenzyl, diphenylmethane, α-benzylnaphthalene), 6:33606 (CONF-810914—4)
**Emission Spectroscopy**
Automated on-line determination of PPB levels of sodium and potassium in low-Btu coal gas and fluidized bed combustor exhaust by atomic emission spectrometry, 6:32861 (IS-M—330)
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Mass Spectroscopy**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)
**Optical Properties**
Surface radiation properties of $ThO_2$ and other reactor materials, 6:33346 (DOE/ET/37227—T4)
**Reflectivity**
Experimental design for reflection measurements of highly reactive liquid or solid substances with application to liquid sodium, 6:33345 (DOE/ET/37227—T2)
**SODIUM 23 TARGET**
**Neon 20 Reactions**
Two-proton correlation measurements in 800 and 400 MeV/nucleon heavy-ion reactions, 6:34008
**SODIUM CHLORIDES**
**Dissociation**
Kinetics of dissociative vaporization reactions, 6:33604
**Physical Properties**
Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981, 6:33192 (DOE/CS/30174—T2Vol.1)
**Sorption**
Studies of the regeneration of activated bauxite used as granular sorbent for the control of alkali vapors from hot flue gas of coal combustion, 6:33269 (ANL/CEN/FE—81-1)
**SODIUM COMPOUNDS**
Use of alkali metal-acid phosphates for elevated temperature water electrolysis, 6:33077 (UCRL—86623)
**SODIUM SULFATES**
**Physical Properties**
Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981, 6:33192 (DOE/CS/30174—T2Vol.1)
**SOILS**
**Activation Analysis**
Multielement analysis of soil of a sewage-farm by photon and neutron activation analysis using waste incineration ash as reference material, 6:33786 (CONF-800433—)
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Geochemistry**
Geochemical exploration for uranium in the Red Desert, Wyoming, 6:33001 (GJBX—125(81))
**Multi-Element Analysis**
Multielement analysis of soil of a sewage-farm by photon and neutron activation analysis using waste incineration ash as reference material, 6:33786 (CONF-800433—)
**PIXE Analysis**
Element analysis by PIXE of environmental samples of the Brazilian Cerrado, 6:33813 (CONF-800433—)
**Radiation Monitoring**
Environmental radiological survey of the intermediate-level waste system pipeline, 6:33803 (ORNL/TM—7858)
**Radioactivity**
Environmental concentration and migration of $^{129}I$, 6:33767 (PNL-SA—9140)
Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)
**Radionuclide Migration**
Unsaturated moisture and radionuclide transport: laboratory analysis and modeling, 6:33804 (PNL—3616)
**Seismic Effects**
Computation of seismic wave fields and soil-structure interaction, 6:33927 (DPST—81-262)
**Sorptive Properties**
Unsaturated moisture and radionuclide transport: laboratory analysis and modeling, 6:33804 (PNL—3616)
**SOLAR ACCESS**
**Bibliographies**
Solar access and land use planning: a bibliography, 6:33103
**SOLAR AIR CONDITIONING**
**Demonstration Programs**
Commercialization survey for the Department of Energy's solar buildings demonstration program, 6:33191 (DOE/SF/11446—T1)
**Institutional Factors**
Institutional analysis of solar heating and cooling of housing: summary report, 6:33101 (MIT-EL—79-044)
Research design for institutional analysis of HUD's solar heating and cooling demonstration program, 6:33099 (MIT-EL—79-029)
Solar heating and cooling of housing: five institutional analysis case studies, 6:33100 (MIT-EL—79-030)
Solar heating and cooling standard setting: an institutional analysis case study, 6:33181 (MIT-EL—79-045)
**Standards**
Solar heating and cooling standard setting: an institutional analysis case study, 6:33181 (MIT-EL—79-045)
**SOLAR ARCHITECTURE**
MASEC Solar 80 home designs, 6:33178 (MASEC-PA—80-007)
**SOLAR CELL ARRAYS**
*See also COMBINED COLLECTORS*
*PHOTOVOLTAIC POWER SUPPLIES*
**Modifications**
Commerical (terrestrial) and modified solar array design studies for low cost, low power space applications, 6:33134 (NASA-TM—81622)
**Performance Testing**
Bias-humidity testing of solar-cell modules, 6:33108 (DOE/JPL—1012-78/11)

**Thermal Degradation**
Commerical (terrestrial) and modified solar array design studies for low cost, low power space applications, 6:33134 (NASA-TM—81622)

**SOLAR CELL RECEIVERS**
*See SOLAR RECEIVERS*

**SOLAR CELLS**
*See also CADMIUM SULFIDE SOLAR CELLS*
*GALLIUM ARSENIDE SOLAR CELLS*
*SILICON SOLAR CELLS*

**Manufacturing**
Development of simplified process for environmentally resistant cells. Final report, 8 Jun. 1978 - 30 Nov. 1980, 6:33144 (NASA-CR—163884)

**Process Development Units**
Module experimental process system development unit (MEPSDU). Quarterly report No. 2, March 1, 1981-May 31, 1981, 6:33113 (DOE/JPL/955902—81/2)

**Production**
Module experimental process system development unit (MEPSDU). Quarterly report No. 2, March 1, 1981-May 31, 1981, 6:33113 (DOE/JPL/955902—81/2)

**Quantum Efficiency**
Spectral response measurements for solar cells, 6:33116 (PNL-SA—9751)

**Spectral Response**
Spectral response measurements for solar cells, 6:33116 (PNL-SA—9751)

**SOLAR COOLING SYSTEMS**

**Absorption Refrigeration Cycle**
Overview of active solar absorption/Rankine cooling program, 6:33174 (LBL—13054-Rev.)

**Demonstration Programs**
Institutional analysis of the solar heating and cooling residential demonstration program, 6:33182 (MIT-EL—80-024)

**Meetings**
Annual DOE active solar heating and cooling contractors' review meeting. Premeeting proceedings and project summaries, 6:33160 (CONF-810912—(Prelim.))

**Optimization**
Optimization of solar heating and cooling systems, 6:33184 (NP—1903997)

**Rankine Cycle Engines**
Overview of active solar absorption/Rankine cooling program, 6:33174 (LBL—13054-Rev.)

**Research Programs**
Overview of active solar absorption/Rankine cooling program, 6:33174 (LBL—13054-Rev.)

**SOLAR ENERGY**

**Demonstration Programs**
Availability of solar energy reports from the National Solar Data Program, 6:33092 (SOLAR/0020—81/44)

**Information**
Availability of solar energy reports from the National Solar Data Program, 6:33092 (SOLAR/0020—81/44)

**Institutional Factors**
Solar energy for California's residential sector: progress, problems, and prospects, 6:33104

**Investment**
Prospects for investment in solar energy, 6:33091 (SERI/TP—351-508)

**Program Management**
Quarterly report of solar federal buildings program in the MASEC region, 6:33180 (MASEC/R—81-059/1)

**Research Programs**
Status of solar energy research and development in Australia, 6:33090 (NP—1903916)

**Supply and Demand**
Basic facts about Colorado's energy resources and reserves, 6:33386

**Technology Assessment**
Technology characterizations: environmental information handbook. Second edition, 6:33840 (DOE/EP—0028)

**Training**
Solar energy training program for code enforcement personnel, 6:33176 (MASEC-CF—81-023)
Vocational-technical instructors passive-solar training workshop, 6:33175 (MASEC-CF—81-019)

**SOLAR ENERGY CONVERSION**

**Bibliographies**
Solar power generation: a bibliography with abstracts. Quarterly update, January-March 1981, 6:33093 (TAC-STPG—81-001)

**SOLAR ENERGY RESEARCH INSTITUTE**

**Research Programs**
Thermal and electrochemical biomass conversion at SERI, 6:33121 (SERI/TP—622-1174)

**SOLAR EQUIPMENT**
*See also HELIOSTATS*
*PHOTOELECTROCHEMICAL CELLS*
*PHOTOVOLTAIC POWER SUPPLIES*
*SOLAR CELL ARRAYS*
*SOLAR CELLS*
*SOLAR COOLING SYSTEMS*
*SOLAR FURNACES*
*SOLAR HEATING SYSTEMS*
*SOLAR WATER HEATERS*

**Consumer Protection**
Solar consumer assurance: an assessment of mechanisms in the Northeast, 6:33183 (NESEC—9)

**Data Acquisition**
Telephone, mail, and personal questionnaires for data collection (For heating and cooling), 6:33162 (DOE/CS/30209—T4)

**Quality Assurance**
Solar consumer assurance: an assessment of mechanisms in the Northeast, 6:33183 (NESEC—9)

**Surveys**
Telephone, mail, and personal questionnaires for data collection (For heating and cooling), 6:33162 (DOE/CS/30209—T4)

**SOLAR FLUX**

**Attenuation**
Solar energy conversion systems engineering and economic analysis. Volume I, 6:33094 (MIT-EL—79-032-Vol.1)

**Computer Codes**
Solar energy conversion systems engineering and economics analysis. Input definition. Volume II, 6:33095 (MIT-EL—79-033-Vol.2)

**Computerized Simulation**
Solar energy conversion systems engineering and economics analysis. Input definition. Volume II, 6:33095 (MIT-EL—79-033-Vol.2)

**Mathematical Models**
Solar energy conversion systems engineering and economic analysis. Volume I, 6:33094 (MIT-EL—79-032-Vol.1)

**SOLAR FURNACES**
Solar furnace study of zinc sulfate decomposition, 6:33076 (UCRL—86622)

**SOLAR HEATING SYSTEMS**
*See also PASSIVE SOLAR HEATING SYSTEMS*
*SOLAR-ASSISTED HEAT PUMPS*

**Demonstration Programs**
Institutional analysis of the solar heating and cooling residential demonstration program, 6:33182 (MIT-EL—80-024)

**Design**
Guidebook for solar process-heat applications, 6:33167 (DOE/TIC—1027977)
Solar heating and hot water system installed at James Hurst Elementary School, Portsmouth, VA. Final Report, 6:33164 (DOE/NASA/CR—161830)

**Economic Analysis**
Guidebook for solar process-heat applications, 6:33167 (DOE/TIC—1027977)

**Education**
Study guide for fundamentals of solar heating: a correspondence course for the air conditioning industry, 6:33165 (DOE/QQ/04038—T1)

**Manuals**
Study guide for fundamentals of solar heating: a correspondence course for the air conditioning industry, 6:33165 (DOE/QQ/04038—T1)

**Meetings**
Annual DOE active solar heating and cooling contractors' review meeting. Premeeting proceedings and project summaries, 6:33160 (CONF-810912—(Prelim.))
**Optimization**
Optimization of solar heating and cooling systems, 6:33184 (NP—1903997)
**Performance**
Solar energy system performance evaluation: Montecito Pines, Santa Rosa, California, November 1979-April 1980, 6:33188 (SOLAR/1045—80/14)

**SOLAR INDUSTRY**
**Investment**
Prospects for investment in solar energy, 6:33091 (SERI/TP—351-508)

**SOLAR PONDS**
**Construction**
Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981, 6:33192 (DOE/CS/30174—T2Vol.1)
**Performance**
Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981, 6:33192 (DOE/CS/30174—T2Vol.1)
**Stabilization**
Optical transparency of inexpensive salt solutions for construction of density-gradient ponds, 6:33199 (SERI/RR—641-615)

**SOLAR PROCESS HEAT**
Guidebook for solar process-heat applications, 6:33167 (DOE/TIC—1027977)
**Meetings**
Solar thermal energy: abstracts of a special seminar for industry, 6:33185 (SAND—81-0373)
**Program Management**
Evaluation of the passive solar for agriculture program, 6:33179 (MASEC/R—81-045)
**Retrofitting**
Solar thermal energy: abstracts of a special seminar for industry, 6:33185 (SAND—81-0373)
**Tower Focus Power Plants**
Comparative economics of solar thermal central receivers, 6:33147 (SAND—81-8236)

**SOLAR RADIATION**
**Absorption**
Solar energy conversion systems engineering and economic analysis. Volume I, 6:33094 (MIT-EL—79-032-Vol.1)
**Computer Codes**
Terrestrial solar spectral modeling, 6:33096 (SERI/TP—642-1343)
**Computerized Simulation**
Terrestrial solar spectral modeling, 6:33096 (SERI/TP—642-1343)
**Spectra**
Terrestrial solar spectral modeling, 6:33096 (SERI/TP—642-1343)

**SOLAR RECEIVERS**
*See also CAVITY RECEIVERS*
*CENTRAL RECEIVERS*
**Computer Codes**
Edge stresses in spherical-shell solar receivers, 6:33193 (DOE/ET/21015—11)
**Domed Structures**
Edge stresses in spherical-shell solar receivers, 6:33193 (DOE/ET/21015—11)
**Stresses**
Edge stresses in spherical-shell solar receivers, 6:33193 (DOE/ET/21015—11)

**SOLAR REPOWERING**
**Economic Analysis**
Improved effectiveness of solar repowering in the utilities with high coal generation, 6:33140 (ATR—80(7873)-4)

**SOLAR RIGHTS**
**Bibliographies**
Solar access and land use planning: a bibliography, 6:33103

**SOLAR SPACE HEATING**
**Demonstration Programs**
Commercialization survey for the Department of Energy's solar buildings demonstration program, 6:33191 (DOE/SF/11446—T1)
**Institutional Factors**
Institutional analysis of solar heating and cooling of housing: summary report, 6:33101 (MIT-EL—79-044)
Research design for institutional analysis of HUD's solar heating and cooling demonstration program, 6:33099 (MIT-EL—79-029)
Solar heating and cooling of housing: five institutional analysis case studies, 6:33100 (MIT-EL—79-030)
Solar heating and cooling standard setting: an institutional analysis case study, 6:33181 (MIT-EL—79-045)
**Program Management**
Evaluation of the passive solar for agriculture program, 6:33179 (MASEC/R—81-045)
**Standards**
Solar heating and cooling standard setting: an institutional analysis case study, 6:33181 (MIT-EL—79-045)

**SOLAR THERMAL POWER PLANTS**
*See also DISTRIBUTED COLLECTOR POWER PLANTS*
*TOWER FOCUS POWER PLANTS*
**Hybrid Systems**
Storage requirement definition study. final report, 6:33143 (NASA-CR—163882)

**SOLAR THERMAL RECEIVERS**
*See SOLAR RECEIVERS*

**SOLAR WATER HEATERS**
**Design**
Solar heating and hot water system installed at James Hurst Elementary School, Portsmouth, VA. Final Report, 6:33164 (DOE/NASA/CR—161830)
**Education**
Study guide for fundamentals of solar heating: a correspondence course for the air conditioning industry, 6:33165 (DOE/QQ/04038—T1)
**Manuals**
Study guide for fundamentals of solar heating: a correspondence course for the air conditioning industry, 6:33165 (DOE/QQ/04038—T1)
**Performance**
Solar energy system performance evaluation: Cathedral Square, Burlington, Vermont, January 1980-December 1980, 6:33189 (SOLAR/1060—81/14)
Solar energy system performance evaluation: Aratex Services, Fresno, California, December 1979-November 1980, 6:33190 (SOLAR/2008—81/14)
Solar energy system performance evaluation: Forest City Dillon, Washington, DC, January 1980-December 1980, 6:33187 (SOLAR/1041—81/14)

**SOLAR-ASSISTED HEAT PUMPS**
**Comparative Evaluations**
Parametric sensitivity study for solar-assisted heat-pump systems. Final report, 6:33186 (SERI/TR—98288-1)
**Economic Analysis**
Parametric sensitivity study for solar-assisted heat-pump systems. Final report, 6:33186 (SERI/TR—98288-1)
**Sensitivity Analysis**
Parametric sensitivity study for solar-assisted heat-pump systems. Final report, 6:33186 (SERI/TR—98288-1)

**SOLID WASTES**
*See also MINERAL WASTES*
**Environmental Impacts**
Solid waste, 6:33841 (DOE/EP/10012—1)
**Waste Product Utilization**
Development of potential uses for the residue from fluidized-bed-combustion processes. Quarterly technical progress report, March-May 1981, 6:33466 (DOE/ET/10415—T4)
**Waste Storage**
Development of potential uses for the residue from fluidized-bed-combustion processes. Quarterly technical progress report, March-May 1981, 6:33466 (DOE/ET/10415—T4)

**SOLIDS**
**Reflectivity**
Experimental design for reflection measurements of highly reactive liquid or solid substances with application to liquid sodium, 6:33345 (DOE/ET/37227—T2)
**Strains**
Finite element analysis of the split Hopkinson bar, 6:34044 (LA—8921-MS)
**Stresses**
Finite element analysis of the split Hopkinson bar, 6:34044 (LA—8921-MS)
**SOLVENT-REFINED COAL**
**Chemical Composition**
Organically bound metals in a solvent-refined coal: metallograms for a Wyoming subbituminous coal, 6:32843
**Solidification**
Evaluation of liquid-phase prilling as a technique for SRC solidification, 6:32810 (DOE/ET/10154—T14)
**SOLVENT-REFINING COAL PLANTS**
*See COAL PREPARATION PLANTS*
*SRC PROCESS*
**SOLVENTS**
*See also ORGANIC SOLVENTS*
**Gas Chromatography**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, April 1981-June 1981, 6:32833 (DOE/PC/30041—T6)
**Liquid Column Chromatography**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, April 1981-June 1981, 6:32833 (DOE/PC/30041—T6)
**Mass Spectroscopy**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, April 1981-June 1981, 6:32833 (DOE/PC/30041—T6)
**Recycling**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, April 1981-June 1981, 6:32833 (DOE/PC/30041—T6)
**Spectroscopy**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, April 1981-June 1981, 6:32833 (DOE/PC/30041—T6)
**SOOT**
Soot formation in synfuels. Second quarterly report, 1 January 1981-31 March 1981, 6:33083 (DOE/PC/30304—2)
**Air Pollution Control**
Soot formation in synthetic fuel droplets. Third quarterly technical progress report, April 1 to June 30, 1981, 6:33743 (DOE/PC/30298—T3)
**Catalytic Effects**
Activated carbon catalyzed oxidation of aqueous S(IV) species, 6:33747 (LBL—11986)
Oxidation of $SO_2$ by wet soot particles: application to clouds, fogs, and plumes, 6:33748 (LBL—11986)
**Environmental Effects**
Soot in the Arctic, 6:33753 (LBL—11986)
**Environmental Impacts**
Importance of soot particles and nitrous acid oxidizing $SO_2$ in atmospheric aqueous droplets, 6:33750 (LBL—11986)
**SOUTH AFRICA**
**Underground Mining**
Emphasis in overseas research on underground coal mining: geomechanical implications (Australian report), 6:32904 (CSIRO—2)
**SOUTH CAROLINA**
**Nuclear Parks**
Nuclear energy center conceptual study. Phase III: site specific evaluation. Topical report, environmental, 6:33335 (DOE/OR/06074—1-Vol.3)
**SOUTH DAKOTA**
**Biomass**
Wood resources and utilization patterns in the North Central Region and energy needs for the manufacture of wood products, 6:33114 (MASEC/R—81-005)
**Geochemical Surveys**
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
**SPACE HEATING**
*See also ANNUAL CYCLE ENERGY SYSTEM*
**Waste Heat Utilization**
Utilization of waste heat from major transformer substations. Volume 1. Generic study. Final report, 6:33477 (EPRI-EM—1968(Vol.1))
Utilization of waste heat from major transformer substations. Volume 2. Site-specific study. Final report, 6:33478 (EPRI-EM—1968(Vol.2))
**SPACE LATTICES**
*See CRYSTAL LATTICES*
**SPACE POWER REACTORS**
**Failure Mode Analysis**
Failure mode analysis using state variables derived from fault trees with application, 6:33317 (LA-UR—81-2595)
**SPACECRAFT POWER SUPPLIES**
**Radioisotope Batteries**
Space nuclear safety and fuels program. Progress report, 6:33071 (LA—8904-PR)
**SPARK CHAMBERS**
Imaging alpha particle detector (Patent), 6:33694
**SPARK IGNITION ENGINES**
**Control Systems**
Maximizing efficiency of fuel production and utilization, 6:33489
**Flame Propagation**
Stroboscopic laser shadowgraph study of the effect of swirl on homogeneous combustion in a spark-ignition engine, 6:33488
**Fuel Economy**
Maximizing efficiency of fuel production and utilization, 6:33489
**SPECTRA**
*See also GAMMA SPECTRA*
*X-RAY SPECTRA*
**Measuring Methods**
Random search algorithm for spectrum analysis, 6:33774 (CONF-800433—)
**SPECTROMETERS**
*See also MASS SPECTROMETERS*
*MULTIPARTICLE SPECTROMETERS*
*NMR SPECTROMETERS*
*X-RAY SPECTROMETERS*
**Proportional Counters**
Design and performance of the new cathode readout proportional chambers in LASS, 6:33690 (SLAC-PUB—2642)
**SPENT FUEL CASKS**
**Heat Transfer**
Heat transfer in a fuel pin shipping container (IDENT 1578), 6:33635 (HEDL-SA—2201-FP)
**SPENT FUEL ELEMENTS**
**Reprocessing**
APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste, 6:33318 (BNL—29899)
**Transport**
DISFUL manual, 6:33018 (DOE/SR/01069—1)
**SPENT FUEL STORAGE**
**Computerized Simulation**
DISFUL manual, 6:33018 (DOE/SR/01069—1)
**Criticality**
Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)
**Heat Transfer**
Possibility of multiple temperature maxima in geologic repositories for spent fuel from nuclear reactors, 6:33043
**Temperature Gradients**
Possibility of multiple temperature maxima in geologic repositories for spent fuel from nuclear reactors, 6:33043
**SPENT SHALES**
**Chemical Composition**
Investigations of Occidental Oil Shale, Inc., retort 3E spent shales, 6:32995 (LA—8792-MS)

**Mineralogy**
Investigations of Occidental Oil Shale, Inc., retort 3E spent shales, 6:32995 (LA—8792-MS)
**Waste Disposal**
Effects of oil-shale solid-waste disposal on water quality: current knowledge, information requirements, and research strategy, 6:32997 (PNL-SA—9792)

**SPHEROMAK DEVICES**
**Plasma Macroinstabilities**
GATO: an MHD stability code for axisymmetric plasmas with internal separatrices, 6:34060 (GA-A—16441)
**Stabilization**
Stabilizing windings for the tilting and shifting modes in an inductively formed spheromak, 6:34066 (PPPL—1814)

**SPOIL BANKS**
**Design**
Two-wedge stability analysis based on energy principles, 6:32913
**Excavation**
Develop a winch-drawn dozer blade equipment system: modification A010-spoil-plane for leveling surface mine spoils. Semi-annual technical progress report, 6:32893 (DOE/ET/12394—T2)
**Slope Stability**
Study of the instability of a spoil pile in an open strip coal mine, 6:32912
Two-wedge stability analysis based on energy principles, 6:32913

**SPONTANEOUS MUTATIONS**
**Radiosensitivity Effects**
Cytoplasmic membrane fractior that promotes septation in an Escherichia coli lon mutant, 6:33898

**SRC PROCESS**
**Demonstration Plants**
Applicability of the industrial source complex dispersion model to the SRC-I Demonstration Plant, 6:32825 (DOE/OR/03054—3)
Coal storage study, 6:32823 (DOE/OR/03054—3)
Particulate control in process area 12 (solvent-refined coal process and deashing), 6:32826 (DOE/OR/03054—3)
Site confirmation study, 6:32824 (DOE/OR/03054—3)
SRC-I quarterly technical report, January-March 1981 (Eleven special engineering studies), 6:32821 (DOE/OR/03054—3)
**Pilot Plants**
Solvent-refined-coal (SRC) process. Quarterly technical progress report, July 1980-September 1980, 6:32809 (DOE/ET/10104—8)
**Quality Control**
SRC-I Demonstration Plant analytical laboratory, 6:32829 (DOE/OR/03054—3)

**SRC-II PROCESS**
**Pilot Plants**
Solvent-refined-coal (SRC) process. Quarterly technical progress report, July 1980-September 1980, 6:32809 (DOE/ET/10104—8)

**STAINLESS STEEL-304**
**Chemical Reactions**
Chemical thermodynamic analysis of the interaction of 304 SS with the gases and the $CaSO_4$ deposit in the fluidized-bed combustor, 6:33507 (CONF-810943—2)
**Corrosion**
Chemical thermodynamic analysis of the interaction of 304 SS with the gases and the $CaSO_4$ deposit in the fluidized-bed combustor, 6:33507 (CONF-810943—2)

**STAINLESS STEEL-316**
**Cracks**
Miniaturized fatigue crack growth specimen technology and results, 6:33517 (HEDL-SA—2475)
**Elongation**
Progress in the development of the blanket structural material for fusion reactors, 6:34126 (CONF-801011—(Vol.2))
**Fatigue**
Progress in the development of the blanket structural material for fusion reactors, 6:34126 (CONF-801011—(Vol.2))
**Microstructure**
Comparison of the swelling and the microstructural/microchemical evolution of AISI 316 irradiated in EBR-II and HFIR, 6:33516 (HEDL-SA—2359)
**Physical Radiation Effects**
Comparison of the swelling and the microstructural/microchemical evolution of AISI 316 irradiated in EBR-II and HFIR, 6:33516 (HEDL-SA—2359)
Effects of transmutation products on swelling in 316 stainless steel, 6:33514 (HEDL-SA—2342-FP)
Empirical development of irradiation-induced swelling design equations, 6:33340
In-reactor creep rupture of 20% cold-worked AISI 316 stainless steel, 6:33535
In-situ observation of radiation damage by 400 keV heavy ions, 6:34128 (CONF-801011—(Vol.2))
Notch tensile behavior of irradiated 20% cold-worked Type 316 stainless steel, 6:33511 (HEDL-SA—2317)
**Swelling**
Comparison of the swelling and the microstructural/microchemical evolution of AISI 316 irradiated in EBR-II and HFIR, 6:33516 (HEDL-SA—2359)
Effects of transmutation products on swelling in 316 stainless steel, 6:33514 (HEDL-SA—2342-FP)
**Weldability**
Measurement of strain across a transition joint interface using Moire fringes (Between 2 1/4 Cr-1 Mo and 316 ss pipes.), 6:33325 (R/M/N—1068)
**Welded Joints**
Interfacial structures in nickel-based transition joints after long term service (From Ratcliffe Power Station), 6:33266 (RD/M/N—1131)
**Yield Strength**
Progress in the development of the blanket structural material for fusion reactors, 6:34126 (CONF-801011—(Vol.2))

**STAINLESS STEEL-316L**
**Shielded Metal-Arc Welding**
Evaluation of shielded metal arc and flux cored metal arc welding consumables for fabrication of stainless steel magnet cases for 4K service, 6:33640 (UCRL—85564)

**STAINLESS STEELS**
*See also STAINLESS STEEL-304*
*STAINLESS STEEL-316*
**Chemical Radiation Effects**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Corrosion**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Impact Shock**
Fracturing of simulated high-level waste glass in canisters, 6:33041 (PNL—3948)
**Microstructure**
Microstructural examination of several commercial ferritic alloys irradiated to high fluence, 6:33512 (HEDL-SA—2338-FP)
**Physical Radiation Effects**
Microstructural examination of several commercial ferritic alloys irradiated to high fluence, 6:33512 (HEDL-SA—2338-FP)
**Thermal Stresses**
Fracturing of simulated high-level waste glass in canisters, 6:33041 (PNL—3948)

**STANDARDS**
*See also ENERGY EFFICIENCY STANDARDS*
*SAFETY STANDARDS*
**Decision Making**
Dose/response relationships and policy formulation, 6:34042 (PNL-SA—9317)

**STANDARDS (SAFETY)**
*See SAFETY STANDARDS*

**STANDING CROP**
*See BIOMASS*

**STAR EVOLUTION**
**Helium Burning**
Low-mass evolution from He ignition to beyond the horizontal branch, 6:33940
**STAR MODELS**
**Helium Burning**
Core helium flash, 6:33941
**STARFIRE TOKAMAK**
**Breeding Blankets**
First-wall/blanket design for the STARFIRE tokamak reactor, 6:34143 (CONF-801011—(Vol.3))
**Design**
Utility impact on STARFIRE design, 6:34166 (CONF-801011—(Vol.3))
**First Wall**
First-wall/blanket design for the STARFIRE tokamak reactor, 6:34143 (CONF-801011—(Vol.3))
**Maintenance**
STARFIRE remote maintenance and reactor facility concept, 6:34107 (CONF-801011—(Vol.2))
**Shielding**
Importance of shield design in minimizing radioactive material inventory in tokamaks, 6:34094 (CONF-801011—(Vol.1))
**Specifications**
Power conversion and balance of plant considerations for the STARFIRE commercial tokamak reactor, 6:34167 (CONF-801011—(Vol.3))
**Superconducting Magnets**
Superconducting toroidal field coil system for STARFIRE, 6:34089 (CONF-801011—(Vol.1))
**STATE GOVERNMENT**
**Energy Conservation**
Annual report to the President and the Congress on the State Energy Conservation Program for calendar year 1980, 6:33394 (DOE/CE—0016)
**STATISTICS**
Bivariate distributions with given marginals and fixed measures of dependence, 6:34200
Problems associated with approximating distributions, 6:34199
**Moments Method**
Estimation problems associated with the Weibull distribution, 6:34194 (ORNL/CSD—79)
**STEAM GENERATORS**
**Loss of Flow**
Loss-of-feed water transients in PWR U-tube steam generators: simulation experiments and analysis, 6:33367
**Molten Metal-Water Reactions**
Pressure transient analysis of elbow-pipe experiments using the PTA-2 computer code (LMFBR), 6:33364
**Stress Corrosion**
Method for controlled stress corrosion cracking in nonsensitized inconel 600 tubing, 6:33329
**STEAM INJECTION**
**Cogeneration**
Cogeneration potential: enhanced oil recovery. Final report, 6:32970 (EPRI-EM—1996)
**Meetings**
Project DEEP STEAM: fourth meeting of the technical advisory panel, Albuquerque, NM, November 1980, 6:32971 (SAND—81-0043)
**STEAM LINES**
**Welded Joints**
Thermal cycling behavior of a cracked transition joint between austenitic and ferritic steels welded with austenitic weld metal, 6:33328 (R/M/R—271)
**STEAM TURBINES**
**Corrosion Products**
Neutron-activation analysis of turbine deposits. Interim report, 6:33573 (EPRI-CS—1958)
**Research Programs**
Program Plan: research and development for improved efficiency, small steam turbine project No. 1380, Phase II (For 500 to 5,000 hp), 6:33468 (DOE/ET/15426—T7)
**STEELS**
*See also AUSTENITIC STEELS*
*CARBON STEELS*
*CHROMIUM STEELS*
*STAINLESS STEELS*
**Ductility**
Engineering approach for elastic-plastic fracture analysis, 6:33510 (EPRI-NP—1931)
**Fracture Properties**
Engineering approach for elastic-plastic fracture analysis, 6:33510 (EPRI-NP—1931)
Structural Mechanics Program: progress in 1980, 6:33289 (EPRI-NP—1969-SR)
**Optical Properties**
Surface radiation properties of $ThO_2$ and other reactor materials, 6:33346 (DOE/ET/37227—T4)
**Physical Radiation Effects**
Structural Mechanics Program: progress in 1980, 6:33289 (EPRI-NP—1969-SR)
**Stress Corrosion**
Structural Mechanics Program: progress in 1980, 6:33289 (EPRI-NP—1969-SR)
**STELLARATORS**
**Helical Instability**
Helical equilibrium, 6:34067 (PPPL—1829)
**Reviews**
Stellarator program, 6:34182 (PPPL—1832)
**STEM CELLS**
**Cell Differentiation**
Unstable cellular differentiation in adenosquamous cell carcinoma, 6:33856
**STEROLS**
*See also BILE ACIDS*
**Biological Effects**
Diminished osmotic fragility of human erythrocytes following the membrane insertion of oxygenated sterol compounds, 6:33855
**STIRLING ENGINES**
**Performance Testing**
High-power baseline and motoring test results for the GPU-3 Stirling engine, 6:33490 (DOE/NASA/51040—31)
**STORAGE (SPENT FUEL)**
*See SPENT FUEL STORAGE*
**STRAIN GAGES**
**Performance Testing**
Transient temperature response of strain gages, 6:33700 (SAND—80-2689)
**Response Functions**
Computer modeling of piezoresistive gauges, 6:33702 (UCRL—85763-Rev.1)
**STRAINS**
**Computer Calculations**
Finite element analysis of the split Hopkinson bar, 6:34044 (LA—8921-MS)
**STRAND BREAKS**
**Biological Repair**
Sensitivity of excision repair in normal human, xeroderma pigmentosum variant and Cockayne's syndrome fibroblasts to inhibition by cytosine arabinoside, 6:33893
**STRATEGIC PETROLEUM RESERVE**
Preparing for an oil crisis: elements and obstacles in crisis management, 6:33403
**STRATOSPHERE**
**Mathematical Models**
Summary of the LLNL one-dimensional transport-kinetics model of the troposphere and stratosphere: 1981, 6:33952 (UCID—19185)
**Photochemical Reactions**
Summary of the LLNL one-dimensional transport-kinetics model of the troposphere and stratosphere: 1981, 6:33952 (UCID—19185)
**STREAK PHOTOGRAPHY**
Design of neutron streak camera for fusion diagnostics, 6:34072 (UCRL—86162)
**Switching Circuits**
Picosecond high-power switching at the Los Alamos National Laboratory, 6:33698 (LA—8720)
**STREAMS**
*See also RIVERS*

**Chemical Analysis**
Resource characterization for uranium mineralization in the Montrose 1° x 2° quadrangle, Colorado, 6:33015 (LA-UR—81-2451)
**Geochemistry**
Stream sediment detailed geochemical survey for Date Creek Basin, Arizona, 6:33006 (GJBX—243-81)

**STRENGTH (COMPRESSION)**
*See COMPRESSION STRENGTH*

**STREPTOMYCES**
**Metabolism**
Degradation of softwood, hardwood, and grass lignocelluloses by two Steptomyces strains, 6:33872

**STRESS ANALYSIS**
**Computer Codes**
Preliminary evaluation of two stress-analysis computer programs based on the displacement-discontinuity and finite-element methods, 6:32905 (CSIRO—3)
**Mathematical Models**
Initial mathematical modelling study of the relationship between underground working conditions and overlying surface topography with reference to the Western Coalfields, N.S.W., 6:32922

**STRESSES**
*(Mechanics.)*
**Computer Calculations**
Finite element analysis of the split Hopkinson bar, 6:34044 (LA—8921-MS)
**Measuring Methods**
Field assessment of hydraulic fracturing as a stress measurement technique for near-surface applications: Stage 1, 6:32916

**STRIPPER FOILS**
*See BEAM STRIPPERS*

**STRONTIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)

**STRONTIUM 85**
**Environmental Transport**
Unsaturated moisture and radionuclide transport: laboratory analysis and modeling, 6:33804 (PNL—3616)
**Sorption**
Unsaturated moisture and radionuclide transport: laboratory analysis and modeling, 6:33804 (PNL—3616)

**STRONTIUM 90**
**Radiation Monitoring**
Northern Marshall Islands radiological survey: sampling and analysis summary, 6:33828 (UCRL—52853-Pt.1)
**Radioecological Concentration**
Northern Marshall Islands radiological survey: radionuclide concentrations in fish and clams and estimated doses via the marine pathway, 6:33829 (UCRL—53853-Pt.3)
**Renal Clearance**
Radioactivity measurements of former military personnel exposed to weapon debris, 6:33892

**STRONTIUM FLUORIDES**
**Crystal Doping**
Equilibrium between type I and type II $M^{3+}$-$F_1^-$ complexes in alkaline earth fluorides, 6:33601

**SULFATES**
**Deposition**
Comparison of regional scale effects of in-cloud conversion of $SO_2$ to $SO_4$/sup =/ in an eight-layer diabatic model with a single-layer model, 6:33760 (PNL-SA—8432)
**Mass Balance**
Comparison of regional scale effects of in-cloud conversion of $SO_2$ to $SO_4$/sup =/ in an eight-layer diabatic model with a single-layer model, 6:33760 (PNL-SA—8432)

**SULFITES**
**Chemical Reaction Kinetics**
Aqueous reactions of nitrite and bisulfite, 6:33749 (LBL—11986)
**Oxidation**
Fossil energy, 6:32862 (LBL—12000)
Oxidation of metal sulfites by iodine for use in thermochemical hydrogen cycles, 6:33073 (LA-UR—81-2477)
Processes and techniques, 6:32839 (LBL—12000)

**SULFUR**
**Chemical Reactions**
CaO interactions in the staged combustion of coal. Third quarterly technical progress report, April 1, 1981-June 30, 1981 (Reaction with $FeS_2$ and with sulfur), 6:32946 (DOE/PC/30301—3)
**Metallurgical Effects**
Relative effects of S, Sb and P on the intergranular fracture of iron and nickel tested at cathodic potentials, 6:33531 (PNL-SA—9446)
**Removal**
Kinetics of oxydesulfurization of Upper Freeport coal, 6:32838

**SULFUR DIOXIDE**
**Air Pollution Abatement**
Tennessee Valley Authority atmospheric fluidized-bed combustor simulation interim annual report, January 1-December 31, 1980, 6:33265 (ORNL/TM—7847)
**Air Pollution Control**
Design and implementation of a demonstration supplementary control system, 6:33271 (MIT-EL—80-033)
**Atmospheric Chemistry**
Comparison of regional scale effects of in-cloud conversion of $SO_2$ to $SO_4$/sup =/ in an eight-layer diabatic model with a single-layer model, 6:33760 (PNL-SA—8432)
**Chemical Reaction Kinetics**
Kinetics of the reaction between $NH_3OH$ and $SO_2$ in aqueous solutions, 6:33751 (LBL—11986)
**Mass Balance**
Comparison of regional scale effects of in-cloud conversion of $SO_2$ to $SO_4$/sup =/ in an eight-layer diabatic model with a single-layer model, 6:33760 (PNL-SA—8432)
**Oxidation**
Activated carbon catalyzed oxidation of aqueous S(IV) species, 6:33747 (LBL—11986)
Importance of soot particles and nitrous acid oxidizing $SO_2$ in atmospheric aqueous droplets, 6:33750 (LBL—11986)
Kinetics of reactions in a wet flue-gas simultaneous desulfurization and denitrification system, 6:32878 (LBL—13063)
Oxidation of $SO_2$ by wet soot particles: application to clouds, fogs, and plumes, 6:33748 (LBL—11986)
Role of fly ash in the catalytic oxidation of $SO_2$, 6:33752 (LBL—11986)
**Removal**
Evaluation of dry alkalis for removing sulfur dioxide from boiler flue gases. Final report, 6:33270 (EPRI-FP—207)
Fossil energy, 6:32862 (LBL—12000)

**SULFUR FLUORIDES**
**Breakdown**
Partial discharge inception and extinction studies in polymer film structures impregnated with compressed $SF_6$ gas, 6:33276 (CONF-811016—2)
**SULFUR OXIDES**
**Monitoring**
MAP3S/RAINE emissions inventory. Progress report, December 1980, 6:33725 (BNL—51378)
**SUPERCONDUCTING FILMS**
**Sputtering**
Coherent multilayer crystals and method of making (Patent), 6:33566
**SUPERCONDUCTING MAGNETS**
**Cooling**
Transient response of a thermal buffer: a study for ISABELLE, 6:33680 (BNL—30008)
**Cooling Load**
Heat-load measurement of prototype cryogenic magnets and leads for the ISABELLE project, 6:33682 (BNL—30010)
Production and use of high-grade silicon-diode temperature sensors, 6:33678 (BNL—30005)
**Cooling Systems**
Design of 24.8-kW, 3.8 K cryogenic system for ISABELLE, 6:33684 (BNL—30013)
**Cryogenic Cables**
Gas cooled electrical leads for use on forced cooled superconducting magnets, 6:33637 (LBL—12783)
**Cryogenics**
Design of 24.8-kW, 3.8 K cryogenic system for ISABELLE, 6:33684 (BNL—30013)
**Design**
General Electric's large superconducting magnet design and development for fusion applications, 6:34086 (CONF-801011—(Vol.1))
Superconducting toroidal field coil system for STARFIRE, 6:34089 (CONF-801011—(Vol.1))
**Engineering**
Engineering and producing the General Dynamics/IGC magnet for the Large Coil Program, 6:34087 (CONF-801011—(Vol.1))
**Fabrication**
Engineering and producing the General Dynamics/IGC magnet for the Large Coil Program, 6:34087 (CONF-801011—(Vol.1))
Evaluation of shielded metal arc and flux cored metal arc welding consumables for fabrication of stainless steel magnet cases for 4K service, 6:33640 (UCRL—85564)
**Physical Radiation Effects**
Radiation effects in superconducting fusion-magnet materials, 6:33537
**Quadrupoles**
Room temperature harmonic analysis of superconducting energy saver quadrupoles, 6:33674
**Refrigeration**
MAGCOOL: the production cooling facility for ISABELLE magnets, 6:33683 (BNL—30011)
**Refrigerators**
Analysis of cooldown performance for ISABELLE helium refrigerator, 6:33681 (BNL—30009)
Cycle design for the ISABELLE helium refrigerator, 6:33679 (BNL—30006)
**Seals**
Cryogenic pressure testing of demountable seals for large-coil program applications, 6:33633 (CONF-810835—12)
**Temperature Measurement**
Production and use of high-grade silicon-diode temperature sensors, 6:33678 (BNL—30005)
**Test Facilities**
MAGCOOL: the production cooling facility for ISABELLE magnets, 6:33683 (BNL—30011)
**Testing**
Two cell double systems test, 6:33676
**Thermal Stresses**
Transient response of a thermal buffer: a study for ISABELLE, 6:33680 (BNL—30008)
**SUPERCONDUCTING WIRES**
**Current Density**
Superconducting current densities in bronze-processed $Nb_3Sn$ multifilamentary wires, 6:33501 (BNL—30018)
**Extrusion**
Comparison of hydrostatic extrusion versus wire drawing as a method of producing $Nb_3Sn$ superconducting wire, 6:33499 (BNL—29941)
**Fabrication**
Superconducting properties of $(Nb,Ti)_3Sn$ wires fabricated by the bronze process, 6:33502 (BNL—30019)
**SUPERCRITICAL FLOW**
*See TURBULENT FLOW*
**SUPERHEAVY ELEMENTS**
*See TRANS 104 ELEMENTS*
**SUPERLATTICES**
**Sputtering**
Coherent multilayer crystals and method of making (Patent), 6:33566
**SUPERNOVAE**
**Gravitational Collapse**
Effect of rotation on the hydrodynamics of stellar collapse, 6:33945
**Hydrodynamics**
Supernova hydrodynamics, 6:33935 (LA-UR—81-2575)
**Rayleigh-Taylor Instability**
Supernova explosions - the role of a Rayleigh-Taylor instability, 6:33946
**Shock Waves**
Core collapse, bounce and shock propagation, 6:33944
Effect of stellar structure on supernova remnant evolution, 6:33947
**SUPEROXIDE RADICALS**
**Chemical Reactions**
Rate of reaction of superoxide radical with chloride-containing species, 6:33598
**SURFACE AIR**
*See also AIR*
*EARTH ATMOSPHERE*
**Radioactivity**
Environmental concentration and migration of $^{129}I$, 6:33767 (PNL-SA—9140)
**SURFACE MINING**
*See also COAL MINING*
*CROSS-RIDGE MINING*
**Planning**
Valuation of surface mining design to improve post-mining land resources, 6:32886 (ANL/LRP-TM—20)
**Productivity**
Analysis of the labor productivity decline in the U.S. bituminous coal mining industry. Final technical report , 6:32906 (DOE/ET/10033—T2)
**Research Programs**
Role of geomechanics research in Australian coal mines, 6:32915
**Slope Stability**
Study of the instability of a spoil pile in an open strip coal mine, 6:32912
**SURFACE WATERS**
*See also COASTAL WATERS*
*LAKES*
*RIVERS*
*STREAMS*
**Radioactivity**
Environmental concentration and migration of $^{129}I$, 6:33767 (PNL-SA—9140)
**SUSPENSIONS (FUEL)**
*See FUEL SLURRIES*
**SWIRL FLOW**
**Flow Models**
Comparisons of turbulent-flow calculations with experiment, 6:33653 (WAPD-TM—1473)
**SWITCHING CIRCUITS**
**Performance**
High voltage, magnetically switched pulsed power systems, 6:33658 (SAND—81-0754C)
Picosecond high-power switching at the Los Alamos National Laboratory, 6:33698 (LA—8720)

**Specifications**
Picosecond high-power switching at the Los Alamos National Laboratory, 6:33698 (LA—8720)
**SWITZERLAND**
**Underground Mining**
Emphasis in overseas research on underground coal mining: geomechanical implications (Australian report), 6:32904 (CSIRO—2)
**SYNTHETIC FUELS**
**Chemical Preparation**
Processes and techniques, 6:32839 (LBL—12000)
**Combustion Products**
Soot formation in synthetic fuel droplets. Third quarterly technical progress report, April 1 to June 30, 1981, 6:33743 (DOE/PC/30298—T3)
Soot formation in synfuels. Second quarterly report, 1 January 1981-31 March 1981, 6:33083 (DOE/PC/30304—2)
**Economics**
Economics of synfuel and gasification systems, 6:32959
**Financial Incentives**
Appendix, 6:33418
**Technology Assessment**
Technology characterizations: environmental information handbook. Second edition, 6:33840 (DOE/EP—0028)
**SYNTHETIC FUELS CORPORATION**
Appendix, 6:33418

## T

**TANKS**
**Design**
Lightweight concrete materials and structural systems for water tanks for thermal storage. Final report, 6:33372 (COO—4703-26)
**Performance Testing**
Lightweight concrete materials and structural systems for water tanks for thermal storage. Final report, 6:33372 (COO—4703-26)
**TANTALUM 181**
**Carbon 12 Reactions**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**Neon 20 Reactions**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**Proton Reactions**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**TANTALUM ALLOYS**
**Crystal-Phase Transformations**
Solution of hydrogen in $TaV_2$, 6:33542
**Yield Strength**
High strength austenitic alloys for generator retaining rings, 6:33527 (LBL—12000)
**TAR SANDS**
*See OIL SANDS*
**TATB**
*(1,3,5-Triamino-2,4,6-trinitrobenzene.)*
**Comparative Evaluations**
Holston-Pantex LX-17 formulation comparison, 6:33712 (MHSMP—81-38)
**Detonations**
Reaction rates from pressure-gauge measurements in reacting explosives, 6:33710 (LA-UR—81-2482)
**Molecular Structure**
Proton and carbon-13 NMR study of stockpile-aged LX-09, 6:33711 (MHSMP—81-37)
**Nuclear Magnetic Resonance**
Proton and carbon-13 NMR study of stockpile-aged LX-09, 6:33711 (MHSMP—81-37)
**TECHNETIUM**
**Biogeochemistry**
Biogeochemical studies of technetium in marine and estuarine ecosystems. Progress report, 1 July 1980-31 July 1981, 6:33827 (DOE/EV/10251—3)
**TECHNETIUM 95**
**Biological Accumulation**
Biokinetic behavior of Tc in the red abalone, Haliotis rufescens: a reassessment (/sup 95m/Tc), 6:33888 (DOE/EV/10251—4)
**TELESCOPES**
**Recovery**
Development of the ARIES parachute system, 6:33639 (SAND—81-0208C)
**TEM (MICROSCOPY)**
*See TRANSMISSION ELECTRON MICROSCOPY*
**TENNESSEE VALLEY AUTHORITY**
**Planning**
Tennessee Valley Authority plans to demonstrate FBC steam power generation from coal, 6:32949
**TERBIUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**TERPENES**
**Polymerization**
Effects of inhibitors on the thermal polymerization of $\beta$-pinene, 6:33553
**TERRESTRIAL ECOSYSTEMS**
**Radionuclide Migration**
Environmental concentration and migration of $^{129}I$, 6:33767 (PNL-SA—9140)
**TEST FACILITIES**
*See also CENTRAL RECEIVER TEST FACILITY*
Sodium boiling and mixed oxide fuel thermal behavior in FBR undercooling transients; W-1 SLSF experiment results, 6:33354 (HEDL-SA—2263-FP)
**Direct Gain Systems**
Verification of BLAST by comparison with measurements of a solar-dominated test cell and a thermally massive building, 6:33172 (LBL—11387)
**TETRAHYDRONAPHTHALENE**
*See TETRALIN*
**TETRALIN**
**Liquid Column Chromatography**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**NMR Spectra**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**Photolysis**
Advanced isotope separation technology, 6:33612 (LBL—12000)
**TEXAS**
**Geothermal Resources**
Look at the Upper Wilcox Rosita Delta system of South Texas, 6:33209
**Strategic Petroleum Reserve**
Microseismic activity observed during depressurization of an oil storage cavern in rock salt, 6:32987 (LA-UR—81-2622)
**TEXTOR TOKAMAK**
**Pressure Vessels**
Finite-element analysis of the TEXTOR vacuum vessel under complex loading conditions, 6:34135 (CONF-801011—(Vol.2))
**TFTR REACTORS**
**Breeding Blankets**
Lithium blanket module tests on the TFTR, 6:34147 (CONF-801011—(Vol.3))
**Calorimeters**
Fusion energy calorimeter for the tokamak fusion test reactor, 6:34053 (CONF-801011—(Vol.3))

**Control Systems**
TFTR control and monitoring system (CICADA), 6:34159 (CONF-801011—(Vol.3))
**Data Acquisition Systems**
TFTR control and monitoring system (CICADA), 6:34159 (CONF-801011—(Vol.3))
**Gamma Radiation**
Fusion energy calorimeter for the tokamak fusion test reactor, 6:34053 (CONF-801011—(Vol.3))
**Getters**
Design of the TFTR Zr/Al surface pumping panels, 6:34161 (CONF-801011—(Vol.3))
Surface pumping system for TFTR impurity and density control, 6:34163 (CONF-801011—(Vol.3))
Thermal analysis of the TFTR surface pumping system, 6:34162 (CONF-801011—(Vol.3))
**Neutron Transport**
Fusion energy calorimeter for the tokamak fusion test reactor, 6:34053 (CONF-801011—(Vol.3))
**Pressure Vessels**
Special features of the TFTR vacuum vessel, 6:34164 (CONF-801011—(Vol.3))
**Remote Handling**
Remote handling methods on TFTR, 6:34160 (CONF-801011—(Vol.3))
**Reviews**
Status of TFTR, 6:34155 (CONF-801011—(Vol.3))
**Safety**
TFTR safety approaches, 6:34106 (CONF-801011—(Vol.2))
**Shielding**
Shielding for TFTR, 6:34158 (CONF-801011—(Vol.3))

**THERMAL ANALYSIS**
**Comparative Evaluations**
Determination of carbon in atmospheric aerosols by deuteron-induced nuclear reactions, 6:33579 (LBL—11986)
Determination of low-Z elements simultaneously by $^{3}$HE-induced nuclear wastes, 6:33580 (LBL—11986)

**THERMAL DECAY TIME LOG**
*See NEUTRON-GAMMA LOGGING*

**THERMAL EFFLUENTS**
**Environmental Effects**
Meteorological Effects of Thermal Energy Releases (METER) program. Annual progress report, October 1979-September 1980, 6:33769 (ORNL/TM—7744)

**THERMAL ENERGY STORAGE EQUIPMENT**
**Demonstration Programs**
Thermal-energy-storage devices, 6:33461
**Design**
Lightweight concrete materials and structural systems for water tanks for thermal storage. Final report, 6:33372 (COO—4703-26)
**Latent Heat Storage**
Conceptual design selection and development of a latent-heat thermal-energy-storage subsystem for a saturated-steam solar receiver and load, 6:33201 (SAND—81-8184)
**Performance Testing**
Lightweight concrete materials and structural systems for water tanks for thermal storage. Final report, 6:33372 (COO—4703-26)

**THERMAL INSULATION**
**Performance Testing**
Analysis of potential attack on insulating materials exposed to sodium. Final report (LMFBR), 6:33306 (EPRI-NP—1986)
**Thermal Conductivity**
Thermal conductivity measurements of insulators for fusion blankets, 6:33498 (BNL—29779)

**THERMAL POLLUTION**
*(Environmental temperature rise due to waste heat disposal)*
**Environmental Effects**
Studies at Plant Bowen: rainfall modification and wetfall chemistry, 6:33722 (ORNL/TM—7744)
**Research Programs**
Meteorological Effects of Thermal Energy Releases (METER) program. Annual progress report, October 1979-September 1980, 6:33769 (ORNL/TM—7744)

**THERMAL POWER PLANTS**
*See also COMBINED-CYCLE POWER PLANTS*
*FOSSIL-FUEL POWER PLANTS*
*GEOTHERMAL POWER PLANTS*
*NUCLEAR POWER PLANTS*
**Cooling Towers**
Magma cooling-tower process pilot-plant demonstration. Final report, 6:33261 (EPRI-CS—1838)
**Design**
First-principle dynamic modeling of an MHD-steam coupled power plant, 6:33268
**Dynamics**
First-principle dynamic modeling of an MHD-steam coupled power plant, 6:33268

**THERMAL STORAGE**
*See HEAT STORAGE*

**THERMIONIC CONVERTERS**
**Program Management**
Program-management plan with critical-path definition for combustion augmentation with thermionic energy conversion (CATEC), 6:33438 (DOE/NASA/1062—9)
**Research Programs**
Program-management plan with critical-path definition for combustion augmentation with thermionic energy conversion (CATEC), 6:33438 (DOE/NASA/1062—9)

**THERMOCHEMICAL PROCESSES**
**Hydrogen Production**
Use of oxide decompositions in advanced thermochemical hydrogen cycles for solar heat sources. Application of the tricobalt tetraoxide-cobalt monoxide pair, 6:33074 (LA-UR—81-2628)

**THERMOCOUPLES**
**Brazing**
Brazing of sensors for high-temperature steam instrumentation systems, 6:33363

**THERMOELECTRIC GENERATORS**
**Radioisotope Heat Sources**
$^{238}$Pu fuel form processes. Quarterly report, October-December 1980, 6:33070 (DPST—80-128-4)

**THERMOELECTRIC MATERIALS**
**Electric Conductivity**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**Fabrication**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**Tensile Properties**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)
**Thermal Conductivity**
Advanced selenide thermoelectric development program. Final report, 6:33562 (TES—32075-107)

**THERMOLUMINESCENT DOSIMETRY**
**Measuring Methods**
New technique of radiation dosimetry based on lyoluminescence, 6:33838 (CONF-800433—)
**Radiation Monitoring**
Environmental radiological survey of the intermediate-level waste system pipeline, 6:33803 (ORNL/TM—7858)

**THERMONUCLEAR DEVICES**
*See also STELLARATORS*
*TOKAMAK DEVICES*
**Design**
TRACT fusion reactor studies, 6:34152 (CONF-801011—(Vol.3))

**THERMONUCLEAR FUELS**
**Environmental Impacts**
Environmental and safety implications of alternate fuel fusion cycles, 6:34102 (CONF-801011—(Vol.2))
**Feasibility Studies**
Potential and status of alternate-fuel fusion, 6:34153 (CONF-801011—(Vol.3))

**THERMONUCLEAR IGNITION**
**Stabilization**
Burn stabilization of an ignited tokamak in a static or pseudostatic vertical field, 6:34080 (CONF-801011—(Vol.1))

**THERMONUCLEAR POWER PLANTS**
**Planning**
Utility perspective on inertial confinement fusion electric power generating plants, 6:34105 (CONF-801011—(Vol.2))

**THERMONUCLEAR REACTIONS**
Environmental and safety implications of alternate fuel fusion cycles, 6:34102 (CONF-801011—(Vol.2))
**THERMONUCLEAR REACTOR COOLING SYSTEMS**
**Radiation Hazards**
Activation product transport in helium cooled fusion systems, 6:34104 (CONF-801011—(Vol.2))
**THERMONUCLEAR REACTOR MATERIALS**
**Electroplating**
Apparatus for electroplating particles of small dimension (Patent), 6:33567
**Materials Testing**
Instrumented in-reactor test capabilities in FFTF, 6:34174 (HEDL-SA—2476-FP)
**Physical Radiation Effects**
Structural design tolerance of radiation swelling: a first step, 6:34131 (CONF-801011—(Vol.2))
**Research Programs**
Progress in the development of the blanket structural material for fusion reactors, 6:34126 (CONF-801011—(Vol.2))
**Swelling**
Structural design tolerance of radiation swelling: a first step, 6:34131 (CONF-801011—(Vol.2))
**THERMONUCLEAR REACTORS**
*(For use in cases where certain aspects of either hypothetical or real thermonuclear reactors are discussed.)*
*See also DOUBLET REACTORS*
*FIELD-REVERSED MIRROR REACTORS*
*I-BEAM TYPE REACTORS*
*JT-60 REACTORS*
*LASER FUSION REACTORS*
*LINUS REACTORS*
*MAGNETIC MIRROR TYPE REACTORS*
*TFTR REACTORS*
*TMR REACTORS*
*TOKAMAK TYPE REACTORS*
**Magnet Coils**
Structural dynamics of toroidal field coil in magentic fusion reactor, 6:34085 (CONF-801011—(Vol.1))
**Meetings**
Technology of controlled nuclear fusion, 6:34138 (CONF-801011—(Vol.3))
Technology of controlled nuclear fusion, 6:34075 (CONF-801011—(Vol.1))
Technology of controlled nuclear fusion, 6:34101 (CONF-801011—(Vol.2))
**Monitoring**
Conceptual fusion power monitor based on the $^{16}O(n,p)^{16}N$ reaction, 6:34108 (CONF-801011—(Vol.2))
**Neutron Transport**
Review of neutronic design criteria, 6:34096 (CONF-801011—(Vol.1))
**Radioactivation**
Activation product transport in helium cooled fusion systems, 6:34104 (CONF-801011—(Vol.2))
**Superconducting Magnets**
General Electric's large superconducting magnet design and development for fusion applications, 6:34086 (CONF-801011—(Vol.1))
**Synthetic Fuels**
Design considerations for high-temperature synthetic fuel production fusion reactors, 6:33064 (CONF-801011—(Vol.2))
**THERMONUCLEAR WEAPONS**
*See NUCLEAR WEAPONS*
**THETA PINCH**
**Magnetic Field Configurations**
Technology issues of tract plasma engineering, 6:34084 (CONF-801011—(Vol.1))
**THIOBACILLUS OXIDANS**
**Metabolism**
Kinetics of the removal of iron pyrite from coal by microbial catalysis, 6:33871
**THORIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**THORIUM ALLOYS**
**Phase Diagrams**
Phase relations in the thorium-cadmium system, 6:33540
**Specific Heat**
Superconductivity in Th-Nb composites, 6:33520 (IS-T—926)
**Superconductivity**
Superconductivity in Th-Nb composites, 6:33520 (IS-T—926)
**Transition Temperature**
Superconductivity in Th-Nb composites, 6:33520 (IS-T—926)
**THORIUM OXIDES**
**Optical Properties**
Surface radiation properties of $ThO_2$ and other reactor materials, 6:33346 (DOE/ET/37227—T4)
**THREE MILE ISLAND-2 REACTOR**
**Pressure Vessels**
In-vessel inspection before head removal: TMI II: Phase I. (Conceptual development), 6:33353 (GEND—010-Vol.1)
**Radioactive Effluents**
Population dose estimation from a hypothetical release of 2.4 x $10^6$ curies of noble gases and 1 x $10^4$ curies of $^{131}I$ at the Three Mile Island Nuclear Station, Unit 2, 6:33361 (ORNL/TM—7980)
**Radioactive Waste Processing**
Effects of high radiation doses on Linde Ion Siv IE-95, 6:33028 (DP-MS—81-18)
**Reactor Accidents**
Population dose estimation from a hypothetical release of 2.4 x $10^6$ curies of noble gases and 1 x $10^4$ curies of $^{131}I$ at the Three Mile Island Nuclear Station, Unit 2, 6:33361 (ORNL/TM—7980)
**Reactor Cores**
In-vessel inspection before head removal: TMI II: Phase I. (Conceptual development), 6:33353 (GEND—010-Vol.1)
**Remote Handling Equipment**
In-vessel inspection before head removal: TMI II: Phase I. (Conceptual development), 6:33353 (GEND—010-Vol.1)
**Remote Viewing Equipment**
In-vessel inspection before head removal: TMI II: Phase I. (Conceptual development), 6:33353 (GEND—010-Vol.1)
**THULIUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**THULIUM 169 TARGET**
**Proton Reactions**
Energy systematics of the giant Gamow-Teller resonance and a charge-exchange dipole spin-flip resonance, 6:34020
**TIN 112 TARGET**
**Proton Reactions**
Energy systematics of the giant Gamow-Teller resonance and a charge-exchange dipole spin-flip resonance, 6:34020
**TIN 124 TARGET**
**Proton Reactions**
Energy systematics of the giant Gamow-Teller resonance and a charge-exchange dipole spin-flip resonance, 6:34020
**TIN ALLOYS**
**Extrusion**
Comparison of hydrostatic extrusion versus wire drawing as a method of producing $Nb_3Sn$ superconducting wire, 6:33499 (BNL—29941)
**Physical Radiation Effects**
Imaging of small distortions in A15 'lattice' by electron microscopy (Neutron irradiation), 6:33528
**Superconductivity**
Superconducting current densities in bronze-processed $Nb_3Sn$ multifilamentary wires, 6:33501 (BNL—30018)
Superconducting properties of $(Nb,Ti)_3Sn$ wires fabricated by the bronze process, 6:33502 (BNL—30019)

**TISSUE EXTRACTS**
**Autoradiography**
Autoradiographic technic for Plutonium, Polonium, and Promethium tissue sections, 6:33857
**TISSUES**
**Multi-Element Analysis**
Retention of metabolized trace elements in rat tissues: silver, cerium, caesium, manganese, scandium and tin, 6:33845 (CONF-800433—)
**TITANATES**
**Photosensitivity**
Effects of ion implantation on the photoferroelectric properties of lead lanthanum zirconate titanate ceramics, 6:33561 (SAND—81-1834C)
**TITANIUM**
*See also TITANIUM-ALPHA*
*TITANIUM-BETA*
**Chemical Radiation Effects**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Corrosion**
Effect of mechanical cleaning on seawater corrosion of candidate OTEC heat exchanger materials. Part 2. Tests with Amertap sponge rubber balls, 6:33149 (ANL/OTEC-BCM—018)
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**TITANIUM ALLOYS**
**Cracks**
Miniaturized fatigue crack growth specimen technology and results, 6:33517 (HEDL-SA—2475)
**Electric Conductivity**
Effect of applied stress on the transformation behavior of Ni-Ti, 6:33518 (IS-M—338)
**Mechanical Structures**
Magnetic fusion energy, 6:33526 (LBL—12000)
**Microstructure**
Magnetic fusion energy, 6:33526 (LBL—12000)
**Phase Studies**
Effect of applied stress on the transformation behavior of Ni-Ti, 6:33518 (IS-M—338)
**Stresses**
Effect of applied stress on the transformation behavior of Ni-Ti, 6:33518 (IS-M—338)
**Superconductivity**
Superconducting properties of $(Nb,Ti)_3Sn$ wires fabricated by the bronze process, 6:33502 (BNL—30019)
**TITANIUM BORIDES**
**Binders**
Effects of binder on the properties of $TiB_2$ based cermets, 6:33551 (ORNL-tr—4766)
**Hot Pressing**
Structure-property correlations for $Tib_2$-based ceramics densified using active liquid metals, 6:33546 (CONF-810856—1)
**Mechanical Properties**
Effects of binder on the properties of $TiB_2$ based cermets, 6:33551 (ORNL-tr—4766)
Structure-property correlations for $Tib_2$-based ceramics densified using active liquid metals, 6:33546 (CONF-810856—1)
**TITANIUM CARBIDES**
**Cracks**
Performance of TiC-coated graphite in electron-beam tests and Doublet III operation, 6:34172 (GA-A—16384)
**TITANIUM HYDRIDES**
**Hydrogen Storage**
Queries concerning local models for hydrogen uptake in metal hydrides, 6:33592
**Phase Transformations**
Queries concerning local models for hydrogen uptake in metal hydrides, 6:33592
**TITANIUM-ALPHA**
**Ion Implantation**
Deuterium retention in titanium alloys exposed in PLT, 6:34132 (CONF-801011—(Vol.2))
**TITANIUM-BETA**
**Ion Implantation**
Deuterium retention in titanium alloys exposed in PLT, 6:34132 (CONF-801011—(Vol.2))
**TMR REACTORS**
**Design**
Design of tandem mirror reactors with thermal barriers, 6:34148 (CONF-801011—(Vol.3))
**Feasibility Studies**
Fission suppressed tandem mirror hybrid reactor options, 6:34117 (CONF-801011—(Vol.2))
**Hydrogen Production**
Hydrogen production based on magnetic fusion, 6:33065 (UCRL—86600)
**Maintenance**
Tandem mirror and tokamak reactor maintainability comparison, 6:34109 (CONF-801011—(Vol.2))
**TMX DEVICES**
**Charged-Particle Transport**
Generating end plug potentials in tandem mirror plasma confinement by heating thermal particles so as to escape low density end stoppering plasmas (Patent), 6:34190
Tandem transport and ambipolarity in the resonant plateau regime, 6:34070 (SAI—254-81-262-LJ)
**TNT**
*(Trinitrotoluene.)*
**Detonations**
Reaction rates from pressure-gauge measurements in reacting explosives, 6:33710 (LA-UR—81-2482)
**TOKAMAK DEVICES**
*See also SPHEROMAK DEVICES*
*TEXTOR TOKAMAK*
**Ballooning Instability**
Comparison of results between the ballooning-modes codes BLOON and BALOON, 6:34063 (ORNL/CSD/TM—157)
**Charged-Particle Transport**
Enhanced fusion product heating via the fast magnetosonic instability, 6:34052 (CONF-801011—(Vol.1))
**Divertors**
Crossed-field divertor for a plasma device (Patent), 6:34192
**Joule Heating**
OHTE confinement test, an engineering overview, 6:34150 (CONF-801011—(Vol.3))
**Limiters**
Novel limiter pump topologies, 6:34171 (DOE/ET/51013—6)
**Magnet Coils**
Analysis of the dynamic behavior of the electric arc for fusion magnet safety, 6:34088 (CONF-801011—(Vol.1))

**Plasma Diagnostics**
Flux of hydrogen from tokamak devices, 6:34051 (CONF-801011—(Vol.1))
**Plasma Instability**
Axisymmetric stability of vertically asymmetric tokamaks at large beta poloidal, 6:34069 (PPPL—1831)
Current driven nonideal instability in a force-free toroidal plasma, 6:34059 (GA-A—16418)
**Plasma Macroinstabilities**
GATO: an MHD stability code for axisymmetric plasmas with internal separatrices, 6:34060 (GA-A—16441)
**Plasma Waves**
Electromagnetic kinetic toroidal eigenmodes for general MHD equilibria, 6:34068 (PPPL—1830)
**Reviews**
Status of tokamak confinement experiments, 6:34078 (CONF-801011—(Vol.1))
**Thermonuclear Fuels**
CAT-D-T tokamaks, 6:34154 (CONF-801011—(Vol.3))

**TOKAMAK TYPE REACTORS**
*See also DOUBLET REACTORS*
*INTOR TOKAMAK*
*ISX TOKAMAK*
*JT-60 REACTORS*
*STARFIRE TOKAMAK*
*TFTR REACTORS*
**Breeding Ratio**
Cost of generating tritium internal and external to a tokamak hybrid reactor, 6:34099 (CONF-801011—(Vol.1))
**Coatings**
Status of low Z coatings for fusion reactor applications, 6:34134 (CONF-801011—(Vol.2))
**Control Systems**
Analysis by hybrid computer simulation of a power level control system for a tokamak fusion reactor plasma, 6:34081 (CONF-801011—(Vol.1))
**Design**
Design studies of commercial magnetic fusion reactors, 6:34170 (CONF-801011—(Vol.3))
OCLATOR: the one coil low aspect toroidal reactor, 6:34189
**Electron Beam Injection**
Electron-beam-driven, compact, steady-state tokamaks, 6:34168 (CONF-801011—(Vol.3))
**Energy Balance**
Effect of impurities and ripple upon power regulation in self-sustained tokamaks, 6:34055 (CONF-801011—(Vol.3))
**Magnetic Surfaces**
Reactor aspects of expanded boundary approach, 6:34082 (CONF-801011—(Vol.1))
**Maintenance**
Tandem mirror and tokamak reactor maintainability comparison, 6:34109 (CONF-801011—(Vol.2))
**Parametric Analysis**
Parametric systems analysis for tokamak hybrid reactors, 6:34116 (CONF-801011—(Vol.2))
**Planning**
Fusion technology program in Japan, 6:34076 (CONF-801011—(Vol.1))
**Poloidal Divertors**
Poloidal divertor target for SLPX, 6:34142 (CONF-801011—(Vol.3))
**Radioactivation**
Activation of containment atmospheres in DT fusion facilities, 6:34095 (CONF-801011—(Vol.1))
**Reactor Fueling**
Fueling and exhaust: an engineering view, 6:34079 (CONF-801011—(Vol.1))
**Thermonuclear Ignition**
Burn stabilization of an ignited tokamak in a static or pseudostatic vertical field, 6:34080 (CONF-801011—(Vol.1))
**Wall Loading**
Effect of wall loading limitations and choice of beta on the feasibility of advanced fuel fusion reactors, 6:34187

**TOP ACCIDENTS**
*See TRANSIENT OVERPOWER ACCIDENTS*

**TOPPING CYCLES**
**Feasibility Studies**
Program-management plan with critical-path definition for combustion augmentation with thermionic energy conversion (CATEC), 6:33438 (DOE/NASA/1062—9)

**TOTAL ENERGY SYSTEMS**
**Combined-Cycle Power Plants**
Assessment of coal-using, combined-cycle, heat-engine options for residential/commercial total and integrated energy systems, 6:33252 (ANL/FE—81-55)
**Feasibility Studies**
Assessment of coal-using, combined-cycle, heat-engine options for residential/commercial total and integrated energy systems, 6:33252 (ANL/FE—81-55)

**TOTAL SUSPENDED PARTICULATES**
**Monitoring**
MAP3S/RAINE emissions inventory. Progress report, December 1980, 6:33725 (BNL—51378)

**TOWER FOCUS POWER PLANTS**
**Cogeneration**
Comparative economics of solar thermal central receivers, 6:33147 (SAND—81-8236)
**Comparative Evaluations**
Comparative economics of solar thermal central receivers, 6:33147 (SAND—81-8236)
**Economic Analysis**
Comparative economics of solar thermal central receivers, 6:33147 (SAND—81-8236)

**TOXIC MATERIALS**
**Environmental Impacts**
Proceedings: workshop on cycling and effects of toxic substances, Carmel, California, October 26-29, 1980, 6:33794 (EPRI-EA—1988)
**Meetings**
Proceedings: workshop on cycling and effects of toxic substances, Carmel, California, October 26-29, 1980, 6:33794 (EPRI-EA—1988)
**Mineral Cycling**
Proceedings: workshop on cycling and effects of toxic substances, Carmel, California, October 26-29, 1980, 6:33794 (EPRI-EA—1988)

**TRANS 104 ELEMENTS**
**Deep Inelastic Heavy Ion Reactions**
Recent searches for superheavy elements in deep-inelastic reactions, 6:34029
**Nucleosynthesis**
Recent searches for superheavy elements in deep-inelastic reactions, 6:34029

**TRANSFER FUNCTIONS**
**Symmetry**
Quadrantal symmetry calculations for nonsymmetric half-plane filters, 6:34197 (UCRL—85156-Rev.1)

**TRANSFER (HEAT)**
*See HEAT TRANSFER*

**TRANSFER RNA**
**Structural Chemical Analysis**
Chromatographic evidence that the AAA-coding isoacceptor of lysine tRNA primes DNA synthesis in murine mammary tumor virus, 6:33875

**TRANSFORMERS**
**Design**
High-voltage air-core pulse transformers, 6:33657 (SAND—80-0451)
**Fabrication**
Partial discharge inception and extinction studies in polymer film structures impregnated with compressed $SF_6$ gas, 6:33276 (CONF-811016—2)
**Heat Recovery**
Utilization of waste heat from major transformer substations. Volume 2. Site-specific study. Final report, 6:33478 (EPRI-EM—1968(Vol:2))
**Load Analysis**
Utilization of waste heat from major transformer substations. Volume 1. Generic study. Final report, 6:33477 (EPRI-EM—1968(Vol.1))

Utilization of waste heat from major transformer substations. Volume 2. Site-specific study. Final report, 6:33478 (EPRI-EM—1968(Vol.2))

**Uses**

High-voltage air-core pulse transformers, 6:33657 (SAND—80-0451)

**Waste Heat**

Utilization of waste heat from major transformer substations. Volume 1. Generic study. Final report, 6:33477 (EPRI-EM—1968(Vol.1))

**TRANSIENT OVERPOWER ACCIDENTS**

**Fault Tree Analysis**

Phased-mission system reliability analysis. Volume 2: computer code. Final report, 6:33350 (EPRI-NP—1945(Vol.2))

**Heat Transfer**

Fuel pin behavior under slow overpower transient conditions; HEDL W-2 SLSF experiment results (LMFBR), 6:33357 (HEDL-SA—2284-FP)

**Hydraulics**

Fuel pin behavior under slow overpower transient conditions; HEDL W-2 SLSF experiment results (LMFBR), 6:33357 (HEDL-SA—2284-FP)

**Test Facilities**

High rate transient mechanical properties of unirradiated fast reactor cladding (LMFBR), 6:33358 (HEDL-SA—2288-S)

**TRANSIENTS**

**Simulation**

Modeling deformation and failure of fast reactor cladding during simulated accident transients, 6:33365

**TRANSITION ELEMENTS**

**Catalytic Effects**

Processes and techniques, 6:32839 (LBL—12000)

**TRANSMISSION ELECTRON MICROSCOPY**

**Resolution**

Metallurgy and ceramics, 6:33699 (LBL—12000)

**TRANSMISSION LINES**

*See POWER TRANSMISSION LINES*

**TRANSPLUTONIUM ELEMENTS**

*See also AMERICIUM*
*FERMIUM*
*LAWRENCIUM*
*MENDELEVIUM*
*NOBELIUM*
*TRANS 104 ELEMENTS*

**Voltametry**

Processes and techniques, 6:32839 (LBL—12000)

**TRANSPORTATION SECTOR**

**Fuel Substitution**

Alternative liquid fuels, 6:33494

**TRANSPORTATION SYSTEMS**

**Comparative Evaluations**

Study description: an environmental comparison of future urban-transportation alternatives, 6:33395

**Energy Supplies**

Options for fueling America's transportation, 6:33463

**TRANSURANIUM COMPOUNDS**

**Radionuclide Migration**

Microautoradiography: a useful technique for investigating radionuclide transport in geologic media, 6:33797 (CONF-800433—)

**TRANSURANIUM ELEMENTS**

*See also NEPTUNIUM*
*PLUTONIUM*
*TRANSPLUTONIUM ELEMENTS*

**Processing**

Current status of the transuranium processing plant, 6:33625

**Radioactive Waste Disposal**

In situ determination of transuranic and fission product radionuclides, 6:33798 (CONF-800433—)

**TREES**

*See also PINES*

**Activation Analysis**

Analysis of fluorine contamination from industrial sources, 6:33907 (CONF-800433—)

**TRINITROTOLUENE**

*See TNT*

**TRITIUM**

**Bibliographies**

Survey of lithium compounds for tritium breeding applications, 6:34133 (CONF-801011—(Vol.2))

**Biological Radiation Effects**

Progress report for mutagenic effect of radionuclides incorporated into DNA of Drosophilia melangaster, 6:33887 (DOE/EV/03728—T1)

**Breeding**

Cost of generating tritium internal and external to a tokamak hybrid reactor, 6:34099 (CONF-801011—(Vol.1))

Neutron spectra and tritium production rate measurements in the one dimensional LiF slab geometry as a fusion reactor blanket benchmark experiment, 6:34090 (CONF-801011—(Vol.1))

Survey of lithium compounds for tritium breeding applications, 6:34133 (CONF-801011—(Vol.2))

**Containment**

Low permeability materials for tritium and tritium removal with organic materials, 6:34097 (CONF-801011—(Vol.1))

**Cost**

Cost of generating tritium internal and external to a tokamak hybrid reactor, 6:34099 (CONF-801011—(Vol.1))

**Diffusion**

Low permeability materials for tritium and tritium removal with organic materials, 6:34097 (CONF-801011—(Vol.1))

**Distribution**

Progress report for mutagenic effect of radionuclides incorporated into DNA of Drosophilia melangaster, 6:33887 (DOE/EV/03728—T1)

**Environmental Transport**

Unsaturated moisture and radionuclide transport: laboratory analysis and modeling, 6:33804 (PNL—3616)

**Oxidation**

Catalytic oxidation efficiencies for tritium and tritiated methane in a mature, industrial-scale decontamination system, 6:34100 (CONF-801011—(Vol.1))

Recent tritium handling experiments at the University of Tokyo, 6:34098 (CONF-801011—(Vol.1))

**Production**

Some political issues related to future special nuclear materials production, 6:33061 (LA—8969-MS)

**Removal**

Catalytic oxidation efficiencies for tritium and tritiated methane in a mature, industrial-scale decontamination system, 6:34100 (CONF-801011—(Vol.1))

Recent tritium handling experiments at the University of Tokyo, 6:34098 (CONF-801011—(Vol.1))

**Sorption**

Unsaturated moisture and radionuclide transport: laboratory analysis and modeling, 6:33804 (PNL—3616)

**TRITON REACTIONS**

**One-Nucleon Transfer Reactions**

Nuclear structure of $^{161}$sup(,)$^{163}$Ho studied with the (t vector,$\alpha$) reaction, 6:34022

**Two-Nucleon Transfer Reactions**

$^{176}$Lu(t,p)$^{178}$Lu reaction. The influence of shell gaps and blocking on L = 0 strenght, 6:34026

$^{136}$sup(,)$^{138}$Ba(t,p) and the systematics of neutron pairing vibrations at N = 82, 6:34021

**TROMBE WALLS**

**Performance**

Comparative thermal performance of direct gain, Trombe, and sunspace walls, 6:33158 (BNL—29970)

**TROPOSPHERE**

**Mathematical Models**

Summary of the LLNL one-dimensional transport-kinetics model of the troposphere and stratosphere: 1981, 6:33952 (UCID—19185)

**Photochemical Reactions**

Summary of the LLNL one-dimensional transport-kinetics model of the troposphere and stratosphere: 1981, 6:33952 (UCID—19185)

**TRUCKS**

**Loading**

Control of the fugitive dust during the loading of trucks with western coal fly ash, 6:32894 (EPRI-WS—79-236)

**TUBES (CONDUITS)**
*See PIPES*
**TUFF**
**Compression Strength**
Importance of creep failure of hard rock in the near field of a nuclear-waste repository, 6:33037 (LA-UR—81-2584)
**Creep**
Importance of creep failure of hard rock in the near field of a nuclear-waste repository, 6:33037 (LA-UR—81-2584)
**Drying**
Evaporative water loss from welded tuff, 6:33021
**Explosive Fracturing**
Small-scale experiments with an analysis to evaluate the effect of tailored pulse loading on fracture and permeability. Final report for Phase II, June 11, 1980-June 11, 1981, 6:32992 (DOE/MC/11577—T23)
**Sorptive Properties**
Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)
**TUMOR CELLS**
**Cell Differentiation**
Unstable cellular differentiation in adenosquamous cell carcinoma, 6:33856
**TUMOR PROMOTERS**
**Radiosensitivity Effects**
Influence of noncarcinogenic secondary factors on radiation carcinogenesis (In vitro; hamsters; x ray), 6:33896
**TUMOR VIRUSES**
*See ONCOGENIC VIRUSES*
**TUMORS**
*See NEOPLASMS*
**TUNGSTEN**
**Atom Collisions**
Direct experimental determination of the particle reflection coefficients of low-energy (100 to 1500 eV) $^{3}He$ and $^{4}He$ atoms from the (110) plane of tungsten, 6:33956 (DOE/ER/03158—93)
**TUNNELS**
**Seismic Effects**
Damage to underground structures during earthquakes, 6:33925 (DPST—81-262)
Numerical modeling of earthquake effects on underground tunnels (Salt, granite, shale), 6:33030 (DPST—81-262)
**TURBINE BLADES**
**Aerodynamics**
Flow curvature effects on darrieus turbine blade aerodynamics, 6:33248
**Erosion**
Improved particle trajectory calculations through turbomachinery affected by coal ash particles, 6:32943
**Freezing**
Review of the icing problem for aerogenerators, 6:33239
**Ice**
Review of the icing problem for aerogenerators, 6:33239
**Performance**
Review of the icing problem for aerogenerators, 6:33239
**TURBINE PUMPS**
*See PUMP TURBINES*
**TURBOGENERATORS**
**Design**
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 9. Design approaches: CAES, Appendix C. Major mechanical equipment. Final report, 6:33369 (EPRI-EM—1589(Vol.9)(App.C))
**TURBULENT FLOW**
**Flow Models**
Comparisons of turbulent-flow calculations with experiment, 6:33653 (WAPD-TM—1473)
**UDIMET 700**
**Corrosion**
Effects of trace impurities in coal-derived liquid fuels on deposition and accelerated high-temperature corrosion of cast superalloys, 6:33509 (DOE/NASA/2593—22)
**UHV AC SYSTEMS**
**Power Transmission Towers**
Impedance characteristics of large tower footings to a 100$\mu$s wide square wave of current, 6:33285
**UNDERGROUND**
**Haulage Equipment**
Evaluation of novel underground transport systems. Final report, 6:32907 (DOE/ET/11268—T3)
**Mine Haulage**
Evaluation of novel underground transport systems. Final report, 6:32907 (DOE/ET/11268—T3)
**Productivity**
Evaluation of novel underground transport systems. Final report, 6:32907 (DOE/ET/11268—T3)
**UNDERGROUND EXPLOSIONS**
*See also NUCLEAR EXPLOSIONS*
**Seismic Effects**
Calculations on seismic coupling of underground explosions in salt, 6:33720 (UCRL—53103)
**UNDERGROUND MINING**
*See also HYDRAULIC MINING*
*LONGWALL MINING*
Emphasis in overseas research on underground coal mining: geomechanical implications (Australian report), 6:32904 (CSIRO—2)
**Productivity**
Analysis of the labor productivity decline in the U.S. bituminous coal mining industry. Final technical report , 6:32906 (DOE/ET/10033—T2)
**Research Programs**
Role of geomechanics research in Australian coal mines, 6:32915
**Roofs**
Analysis of factors influencing roof stability at Wallsend Borehole Colliery, 6:32918
Application of a roof bolt hole penetrometer to the determination of in situ strength of coal-measure sediments, 6:32917
Stress measurement on the Wambo colliery holding and their interpretation in terms of roof conditions, 6:32920
**Seismic Noise**
Microseismic monitoring at 53 Level, West No. 2 mine, Collinsville: a feasibility study, 6:32919
**Stress Analysis**
Initial mathematical modelling study of the relationship between underground working conditions and overlying surface topography with reference to the Western Coalfields, N.S.W., 6:32922
Preliminary evaluation of two stress-analysis computer programs based on the displacement-discontinuity and finite-element methods, 6:32905 (CSIRO—3)
**UNDERGROUND NUCLEAR STATIONS**
**Seismic Effects**
Seismic design considerations for underground nuclear facilities, 6:33348 (DPST—81-262)
**UNDERGROUND POWER TRANSMISSION**
**Electric Cables**
Acoustic waveguide technique for sensing incipient faults in underground power-transmission cables: including acousto-optic techniques. Final report, 6:33277 (DOE/ET/29335—T1)
**UNDERWATER EXPLOSIONS**
**Photography**
Detonation-product behavior at large expansion: the underwater detonation of nitromethane, 6:33714 (UCRL—52903)
**Shock Waves**
Detonation-product behavior at large expansion: the underwater detonation of nitromethane, 6:33714 (UCRL—52903)

**UNIFIED GAUGE MODELS**
**Classical Mechanics**
Radiation reaction force and unification of electromagnetic and gravitational fields, 6:33988 (DOE/ER/03023—T1)
**Computerized Simulation**
Numerical studies of gauge field theories, 6:33987 (BNL—29840)
**Coupling Constants**
Unification of elementary forces, 6:33981
**Many-Dimensional Calculations**
Radiation reaction force and unification of electromagnetic and gravitational fields, 6:33988 (DOE/ER/03023—T1)
**UNITED KINGDOM**
**Underground Mining**
Emphasis in overseas research on underground coal mining: geomechanical implications (Australian report), 6:32904 (CSIRO—2)
**UNITED STATES OF AMERICA**
*See USA*
**URANIUM**
*See also ENRICHED URANIUM*
**Activation Analysis**
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Adsorption**
Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)
**Delayed Neutron Analysis**
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
**Fluorescence Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Mass Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Nuclear Reaction Analysis**
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
**Radionuclide Migration**
Microautoradiography: a useful technique for investigating radionuclide transport in geologic media, 6:33797 (CONF-800433--)
**Solubility**
Factors affecting criticality for spent-fuel materials in a geologic setting, 6:33056 (PNL—3791)
**Superconductivity**
Hill plots and americium, 6:34048
**Supply and Demand**
Basic facts about Colorado's energy resources and reserves, 6:33386
Fuel availability--uranium results of INFCE investigations, 6:33000
**X-Ray Fluorescence Analysis**
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
**URANIUM 235**
**Gamma Spectroscopy**
Gamma-ray spectrometric determination of $UF_6$ assay with 1 percent precision for international safeguards. Part 1. Product and feed in 1S and 2S sample cylinders, 6:33576 (K/OA—5014-Rev.1)
**Mass Spectroscopy**
Gamma-ray spectrometric determination of $UF_6$ assay with 1 percent precision for international safeguards. Part 1. Product and feed in 1S and 2S sample cylinders, 6:33576 (K/OA—5014-Rev.1)
**Nondestructive Analysis**
Application of the active well coincidence counter (AWCC) to high-enrichment uranium metal, 6:33060 (LA—8621-MS)
**URANIUM 238**
**Carbon 12 Reactions**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**Neon 20 Reactions**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**Proton Reactions**
Nuclear chemistry. Progress report, September 1, 1980-July 31, 1981, 6:33994 (DOE/ER/70035—4)
**URANIUM BASE ALLOYS**
**Deformation**
Effects of tensile deformation on the strain memory behavior of uranium-niobium $\alpha''$ martensite, 6:33534 (Y/DV—134)
**Tensile Properties**
Effects of tensile deformation on the strain memory behavior of uranium-niobium $\alpha''$ martensite, 6:33534 (Y/DV—134)
**URANIUM DEPOSITS**
**Aerial Prospecting**
Airborne gamma-ray spectrometer and magnetometer survey: Peoria, Decater, Belleville Quadrangles, (IL). Final report, 6:33005 (GJBX—241-81-Vol.1)
**Exploration**
Geochemical exploration for uranium in the Red Desert, Wyoming, 6:33001 (GJBX—125(81))
One hundred prime references on hydrogeochemical and stream sediment surveying for uranium as internationally practiced, including 60 annotated references, 6:33013 (LA—6647-MS)
Stream sediment detailed geochemical survey for Date Creek Basin, Arizona, 6:33006 (GJBX—243-81)

**Prospecting**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Resource Assessment**
Multisource data set integration and characterization of uranium mineralization for the Montrose Quadrangle, Colorado, 6:33014 (LA—8807-MS)
NDA technology for uranium resource evaluation. Progress report, January 1-June 30, 1980, 6:33036 (LA—8967-PR)
Resource characterization for uranium mineralization in the Montrose 1° x 2° quadrangle, Colorado, 6:33015 (LA-UR—81-2451)

**URANIUM DIOXIDE**
**Reaction Kinetics**
Oxygen potentials of plutonia and urania-plutonia solid solutions, 6:33541
**Thermodynamic Activity**
Oxygen potentials of plutonia and urania-plutonia solid solutions, 6:33541

**URANIUM HEXAFLUORIDE**
**Density**
Measurement of gas density and temperature distributions in strongly rotating $UF_6$ using laser-induced fluorescence, 6:33619 (LA-UR—81-2530)
**Excitation**
Lifetimes of electronically excited $UF_6$ in the presence of inorganic quenchers, 6:33615
**Nondestructive Analysis**
Gamma-ray spectrometric determination of $UF_6$ assay with 1 percent precision for international safeguards. Part 1. Product and feed in 1S and 2S sample cylinders, 6:33576 (K/OA—5014-Rev.1)
**Photolysis**
Diode laser spectroscopy of the transient $UF_5$ radical following laser photolysis of $UF_6$, 6:33958
**Scintillation Quenching**
Lifetimes of electronically excited $UF_6$ in the presence of inorganic quenchers, 6:33615
**Temperature Measurement**
Measurement of gas density and temperature distributions in strongly rotating $UF_6$ using laser-induced fluorescence, 6:33619 (LA-UR—81-2530)

**URANIUM ISOTOPES**
**Emission Spectroscopy**
Application of ICP-AES to the multi-elemental and multi-isotopic analysis of fuel dissolver solutions. Progress report, 6:33059 (IS-M—337)

**URANIUM OXIDES**
*See also URANIUM DIOXIDE*
**Embargoes**
Domestic utility attitudes toward foreign uranium supply, 6:33391 (GJBX—182(81))
**Imports**
Domestic utility attitudes toward foreign uranium supply, 6:33391 (GJBX—182(81))

**URANIUM PENTAFLUORIDE**
**Laser Spectroscopy**
Diode laser spectroscopy of the transient $UF_5$ radical following laser photolysis of $UF_6$, 6:33958

**URANIUM RESERVES**
Fuel availability--uranium results of INFCE investigations, 6:33000
**Resource Assessment**
Preparation of magnetic anomaly profile and contour maps from DOE-NURE aerial survey data. Volume I: processing procedures (National Uranium Resource Evaluation), 6:32999 (ORNL/CSD/TM—155-Vol.1)

**URBAN AREAS**
**Point Pollutant Sources**
Identifying locations of dominant point sources of elements in urban atmospheres from large, multielement data sets, 6:33727 (CONF-800433—)
**Transportation Systems**
Study description: an environmental comparison of future urban-transportation alternatives, 6:33395

**US DOE**
*See also ORNL*
*ROCKY FLATS PLANT*
*SANDIA LABORATORIES*
*SAVANNAH RIVER PLANT*
*SOLAR ENERGY RESEARCH INSTITUTE*
**Federal Assistance Programs**
Commercialization survey for the Department of Energy's solar buildings demonstration program, 6:33191 (DOE/SF/11446—T1)
**Program Management**
Commercialization survey for the Department of Energy's solar buildings demonstration program, 6:33191 (DOE/SF/11446—T1)
**Research Programs**
Combustion systems project appraisal analysis. Final report, 6:33388 (DOE/ET/13113—T2)
Sensitivity analysis of project appraisal variables. Volume II. Additional variables and composite scenarios, 6:33405 (DOE/ET/15078—T9)
United States Department of Energy thermal energy storage program, 6:33373 (DOE/RL/01830—T6)

**US DOI**
**Government Policies**
Minerals management at the Department of the Interior needs coordination and organization, 6:33385 (EMD—81-53)

**US FEA**
**Bibliographies**
Technical reports of the Federal Energy Administration. Cumulative through June 30, 1977, 6:33381 (NTISUB/C—221-404)

**US ORGANIZATIONS**
*See also TENNESSEE VALLEY AUTHORITY*
*US DOE*
*US FEA*
**Nuclear Data Collections**
Minutes of the fifth annual meeting of the panel on reference nuclear data, 6:34201 (BNL-NCS—51364)

**USA**
*(For national information only. See individual states for specific references.)*
*See also GREAT LAKES REGION*
*MIDWEST REGION*
*PACIFIC NORTHWEST REGION*
**Coal Industry**
Analysis of the labor productivity decline in the U.S. bituminous coal mining industry. Final technical report , 6:32906 (DOE/ET/10033—T2)
**Coordinated Research Programs**
Method of investigations, estimation, and classification of roofs in mines in the United States of America for the selection of suitable mechanized support for longwalls. Report No. 1: January 1, 1977-March 31, 1977, 6:32910 (DOE/TIC—11477)

**Energy Consumption**
Dimensions of energy demand (Options for changing growth), 6:33402
**Energy Demand**
Dimensions of energy demand (Options for changing growth), 6:33402
**Energy Policy**
Prospects for diversifying sources of imported oil and gas supplies, 6:33407 (EPRI-WS—79-182)
**Energy Security Act**
Appendix, 6:33418
**Energy Source Development**
Energy in America: fifteen views, 6:32984
**Energy Supplies**
Uranium enrichment: response to an energy crisis, 6:33017
**Foreign Policy**
Perspective on individual regions: the Middle East, 6:33415 (EPRI-WS—79-182)
**Fuel Supplies**
Analysis of gasoline supply for the United States during the 1979 shortage, 6:33398 (BNL—51330)
**Hot-Dry-Rock Systems**
Hot dry rock geothermal prospects, 1981, 6:33219 (LA-UR—81-1807)
**Nuclear Power**
Findings supporting determination related to international nuclear power export activities pending preparation of a section 102(2)(C) NEPA environmental statement, 6:33290 (ERDA—80)
**Power Demand**
Regional load-curve models: scenario and forecast using the DRI model. Final report (Forecasts of electric power loads in 32 US regions), 6:33422 (EPRI-EA—1672(Vol.3))
**Small-Scale Hydroelectric Power Plants**
Micro-hydropower in the United States, 6:33089 (EGG-M—02781)
**Underground Mining**
Emphasis in overseas research on underground coal mining: geomechanical implications (Australian report), 6:32904 (CSIRO—2)
**UTILITIES**
*See ELECTRIC UTILITIES*

## V

**VACUUM POLARIZATION**
**Nonlinear Problems**
Non-linear vacuum polarization in strong fields, 6:33974 (LBL—12972)
**VACUUM SYSTEMS**
**Windows**
Fabricating thin beryllium windows for X-ray applications, 6:33706
**VACUUM ULTRAVIOLET RADIATION**
*See FAR ULTRAVIOLET RADIATION*
**VANADIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Recovery**
Oil ash handling case history, 6:32872 (EPRI-WS—79-236)
**VANADIUM ALLOYS**
**Crystal-Phase Transformations**
Solution of hydrogen in $TaV_2$, 6:33542
**VANADIUM COMPLEXES**
**Chemical Reactions**
Comparative reactivities of two isoelectronic transition-metal hydrides with transition-metal carbonyls and alkyls, 6:33594
**VANADIUM COMPOUNDS**
**Ultraviolet Spectra**
Spectrum and energy levels of quadrupole-ionized vanadium (V v), 6:33603
**VARIABLE STARS**
*See also ERUPTIVE VARIABLE STARS*
*PULSATING VARIABLE STARS*
**Emission Spectra**
New instability strip for hot degenerates, 6:33949
**Photometry**
New instability strip for hot degenerates, 6:33949
**VEGETABLES**
*(Edible parts of plants only.)*
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Radionuclide Kinetics**
Factors affecting radionuclide availability to vegetables grown at Los Alamos, 6:33903
**VEGETATION**
*See PLANTS*
**VEHICLES**
*See also AUTOMOBILES*
*ELECTRIC-POWERED VEHICLES*
*TRUCKS*
**Stirling Engines**
High-power baseline and motoring test results for the GPU-3 Stirling engine, 6:33490 (DOE/NASA/51040—31)
**VENTILATION SYSTEMS**
**Design**
Building ventilation and indoor air quality, 6:33452 (LBL—11985)
**Research Programs**
Building ventilation and indoor air quality, 6:33452 (LBL—11985)
**Standards**
Building ventilation and indoor air quality, 6:33452 (LBL—11985)
**VERA REACTOR**
**Reactor Kinetics**
ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)
**VESSELS**
*See CONTAINERS*
**VESSELS (PRESSURE)**
*See PRESSURE VESSELS*
**VISIBLE RADIATION**
**Attenuation**
Intercomparison of the integrating plate and the laser transmission methods for determination of aerosol absorption coefficients, 6:33754 (LBL—11986)
Soot in the Arctic, 6:33753 (LBL—11986)
**Biological Effects**
Effects of light on biomass and community structure of estuarine detrital microbiota, 6:33917

**VITAMIN A**
**Radiosensitivity Effects**
Influence of noncarcinogenic secondary factors on radiation carcinogenesis (In vitro; hamsters; x ray), 6:33896
**VITAMIN C**
*See ASCORBIC ACID*
**VOLCANOES**
**Plumes**
Nuclear activation analysis methods and the evaluation of volcanic deposits and emissions, 6:33728 (CONF-800433—)
**VOLTAIC CELLS**
*See ELECTRIC BATTERIES*
**VRAIN REACTOR**
**Modifications**
Fort St. Vrain improvement program plan. Draft final report, 6:33300 (DOE/SF/10748—T2)
**Reactor Operation**
Fort St. Vrain improvement program plan. Draft final report, 6:33300 (DOE/SF/10748—T2)

## W

**WAIRAKEI GEOTHERMAL FIELD**
**Flow Models**
Geothermal reservoir simulation capabilities at Systems, Science, and Software (MUSHRM code; CHARM code; LIGHTS code), 6:33213 (LBL—11566)
Role of numerical models in applications to thermohydrological flow in fracture rock masses, 6:33210 (LBL—11566)
**Simulation**
Role of numerical models in applications to thermohydrological flow in fracture rock masses, 6:33210 (LBL—11566)
**WALL LOADING**
Effect of wall loading limitations and choice of beta on the feasibility of advanced fuel fusion reactors, 6:34187
**WALLS**
*See also TROMBE WALLS*
*WATER WALLS*
**Thermal Testing**
Energy performance of buildings, 6:33451 (LBL—11985)
**WASHINGTON**
**Coastal Waters**
Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)
**Wind Power**
Wind power prospecting using aerial reconnaissance, 6:33237
**WASTE PROCESSING**
*See also ACTIVATED SLUDGE PROCESS*
*ANAEROBIC DIGESTION*
*RADIOACTIVE WASTE PROCESSING*
**Aerosol Monitoring**
Precision of the all-glass impinger and the Andersen microbial impactor for air sampling in solid-waste handling facilities, 6:33763
**Combustion**
Anti-pollution solid waste burning incinerator (Patent), 6:33481
**WASTE PROCESSING PLANTS**
**Particle Size Classifiers**
Review of the literature on the use of trommels in waste processing and resource recovery, 6:33474 (DOE/CS/20167—6)
**WASTE PRODUCT UTILIZATION**
**Feasibility Studies**
Economic considerations of reclaiming abandoned tailings ponds and dams, 6:32892 (ANL/LRP-TM—20)
**WASTE WATER**
**Chemical Composition**
Solvent-refined-coal (SRC) process. Quarterly technical progress report, July 1980-September 1980, 6:32809 (DOE/ET/10104—8)
**Denitrification**
Treatment of coal-conversion wastewater with the powdered activated carbon-contact-stabilization activated-sludge process. First annual technical progress report, February 1, 1981-July 31, 1981, 6:32867 (DOE/PC/30233—T2)
**Waste Processing**
Treatment of coal-conversion wastewater with the powdered activated carbon-contact-stabilization activated-sludge process. First annual technical progress report, February 1, 1981-July 31, 1981, 6:32867 (DOE/PC/30233—T2)
**WASTE-FUELED BOILERS**
*See REFUSE-FUELED BOILERS*
**WATER**
*See also GROUND WATER*
*SEAWATER*
*SURFACE WATERS*
*WASTE WATER*
**Chemical Analysis**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
**Dissociation**
Kinetics of dissociative vaporization reactions, 6:33604
**Neutron Diffraction**
Instrument for liquids, amorphous and power diffraction, 6:33578 (LA-UR—81-2531)
**Physical Properties**
Analysis of saturated solar pond characteristics. Final report, October 1, 1979-April 30, 1981, 6:33192 (DOE/CS/30174—T2Vol.1)
**Radiolysis**
Extension of a spur overlap model for the radiolysis of water to include high linear energy transfer regions (10-15 MeV electron pulses), 6:33617
**Radionuclide Migration**
Unsaturated moisture and radionuclide transport: laboratory analysis and modeling, 6:33804 (PNL—3616)
**Sorption**
Unsaturated moisture and radionuclide transport: laboratory analysis and modeling, 6:33804 (PNL—3616)
**WATER COOLED REACTORS**
*See also ACPR REACTOR*
*BWR TYPE REACTORS*
*PWR TYPE REACTORS*
**Departure Nucleate Boiling**
Factors affecting post-DNB operation for light water reactors. Final report, 6:33352 (EPRI-NP—1999(Vol.2))
**Loss of Coolant**
Experimental investigations of two-phase mixture level swell and axial void fraction distribution under high pressure, low heat flux conditions in rod bundle geometry, 6:33343 (CONF-810806—8)
Studies of transition boiling heat transfer with saturated water at 1-4 bar. Final report, 6:33349 (EPRI-NP—1899)
**WATER HEATERS**
*See also ANNUAL CYCLE ENERGY SYSTEM*
*SOLAR WATER HEATERS*
**Performance**
Simulation of a wind-powered water heater, 6:33251
**Specifications**
Simulation of a wind-powered water heater, 6:33251
**WATER POLICY**
Scientific, technological and institutional aspects of water resource policy, 6:33811

**WATER POLLUTION**
**Activation Analysis**
Neutron activation analysis in the survey of river water quality and trace element distribution, 6:33812 (CONF-800433—)
**Chemical Composition**
Neutron activation analysis in the survey of river water quality and trace element distribution, 6:33812 (CONF-800433—)
**Environmental Impacts**
Assessment of optimum aquatic microcosm design for pollution impact studies, 6:33821 (EPRI-EA—1989)
Assessment of optimum microcosm design for pollution impact studies, 6:33911 (LBL—11986)
Water pollution, 6:33832 (DOE/EP/10012—1)
**Environmental Transport**
Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)
**Geochemistry**
Chemical and geochemical studies off the coast of Washington. Progress report, September 1980-July 1981, 6:33820 (DOE/EV/70024—44)
**WATER REMOVAL**
**Economic Analysis**
Peat dewatering: solvent extraction, 6:32942
**Feasibility Studies**
Peat dewatering: solvent extraction, 6:32942
**WATER RESOURCES**
Scientific, technological and institutional aspects of water resource policy, 6:33811
**Energy Source Development**
Water resources, 6:33833 (DOE/EP/10012—1)
**WATER SOLUTIONS**
*See AQUEOUS SOLUTIONS*
**WATER VAPOR**
**Chemical Reactions**
Surface science of heterogeneous catalysis: possible applications in atmospheric sciences, 6:33590 (LBL—12986)
**WATER WALLS**
**Design**
Transwall research, 6:33168 (IS-M—334)
**Performance**
Transwall research, 6:33168 (IS-M—334)
Transwall: a modular visually transmitting thermal storage wall. Status report, 6:33169 (IS-M—345)
**WAZ 16**
*See NICKEL BASE ALLOYS*
**WEAK HADRONIC DECAY**
**Gluon Model**
Soft-gluon effects in nonleptonic decays of charmed mesons, 6:33975
**Scaling Laws**
Non-leptonic weak decay rate of explicitly flavored heavy mesons, 6:33976
**WEAPONS**
*See also NUCLEAR WEAPONS*
**Railgun Accelerators**
Electromagnetic launcher: a new weapon, 6:33641 (UCRL—85877)
**WEATHER**
**Forecasting**
Climatological relationships between monthly mean surface temperature and mid-tropospheric heights. Progress report, November 1, 1980-June 30, 1981, 6:33721 (DOE/EV/10539—T1)
**WELDED JOINTS**
**Cracks**
Finite element analysis of the stress intensity factors of cracks in welded transition joints, 6:33327 (R/M/R—263)
**Performance**
Interfacial structures in nickel-based transition joints after long term service (From Ratcliffe Power Station), 6:33266 (RD/M/N—1131)
**Strains**
Measurement of strain across a transition joint interface using Moire fringes (Between 2 1/4 Cr-1 Mo and 316 ss pipes.), 6:33325 (R/M/N—1068)
**Stress Analysis**
Finite element analysis of the stress intensity factors of cracks in welded transition joints, 6:33327 (R/M/R—263)
**Thermal Cycling**
Creep damage accumulation during thermal cycling of a transition joint, 6:33326 (R/M/R—207)
Thermal cycling behavior of a cracked transition joint between austenitic and ferritic steels welded with austenitic weld metal, 6:33328 (R/M/R—271)
**WELDS**
*See WELDED JOINTS*
**WELL LOGGING**
*See also GAMMA LOGGING*
*NEUTRON-GAMMA LOGGING*
*NUCLEAR MAGNETIC LOGGING*
**Data Analysis**
Basic program for borelog coding of coal-measure sequences using microcomputers, 6:32900
**Data Processing**
Basic program for borelog coding of coal-measure sequences using microcomputers, 6:32900
**WELL LOGGING EQUIPMENT**
Advanced logging techniques, 6:32961 (EPRI-WS—79-182)
**WELLMAN-GALUSHA PROCESS**
**Comparative Evaluations**
Low/medium-Btu coal-gasification assessment of central plant for the city of Philadelphia, Pennsylvania, 6:32836 (DOE/RA/20222—2)
**WEST GERMANY**
*See FEDERAL REPUBLIC OF GERMANY*
**WESTINGHOUSE GASIFICATION PROCESS**
Surface Coal Gasification, 6:32819 (DOE/METC/SP—110)
**WILD ANIMALS**
**Sensitivity**
Wildlife, 6:33843 (DOE/EP/10012—1)
**WIND POWER**
**Aerial Prospecting**
Wind power prospecting using aerial reconnaissance, 6:33237
**Availability**
Estimation of time series models for horizontal wind on the Norwegian west coast, 6:33235
**Fluctuations**
Wind ripple analysis, 6:33240 (DOE/DP/00789—T15)
**Legislation**
Wind Energy Systems Act of 1980, 6:33433
**Mathematical Models**
Wind speed simulation for economic evaluation of wind energy conversion systems, 6:33234 (PNL-SA—9149)
**Monitoring**
Comparative study of wind characteristics from different time periods, 6:33244
**Resource Assessment**
Analysis of data from the US Department of Energy's meteorological validation program, 6:33243 (PNL-SA—9411)
Comparative study of wind characteristics from different time periods, 6:33244
Comparison of height extrapolation models and sensitivity analysis, 6:33236
Estimation of the parameters of the distribution of wind speed and direction, 6:33250
Estimation of time series models for horizontal wind on the Norwegian west coast, 6:33235
Simple model for the probability distribution of wind power with applications to large scale electricity generation, 6:33246
**Variations**
Wind speed simulation for economic evaluation of wind energy conversion systems, 6:33234 (PNL-SA—9149)
**WIND POWER PLANTS**
**Economics**
Integration of wind power into Australian electricity grids without storage: a computer simulation, 6:33238
**Feasibility Studies**
Integration of wind power into Australian electricity grids without storage: a computer simulation, 6:33238

**Power Systems**
Integration of wind power into Australian electricity grids without storage: a computer simulation, 6:33238
**Site Selection**
Analysis of data from the US Department of Energy's meteorological validation program, 6:33243 (PNL-SA—9411)
Simple model for the probability distribution of wind power with applications to large scale electricity generation, 6:33246
**WIND TURBINES**
**Aerodynamics**
General review of the MOSTAS computer code for wind turbines, 6:33241 (DOE/NASA/3303—1)
Performance analysis for horizontal axis wind turbines applicable to variable pitch or airbrake control, 6:33249
**Control Systems**
Performance analysis for horizontal axis wind turbines applicable to variable pitch or airbrake control, 6:33249
**Farms**
Project demonstration of wind-turbine electricity: interconnecting a northern Michigan fruit farm with a major utility, 6:33242 (DOE/R5/10226—1)
**Performance**
Project demonstration of wind-turbine electricity: interconnecting a northern Michigan fruit farm with a major utility, 6:33242 (DOE/R5/10226—1)
**Specifications**
Project demonstration of wind-turbine electricity: interconnecting a northern Michigan fruit farm with a major utility, 6:33242 (DOE/R5/10226—1)
**Turbine Blades**
Flow curvature effects on darrieus turbine blade aerodynamics, 6:33248
Review of the icing problem for aerogenerators, 6:33239
**Water Heaters**
Simulation of a wind-powered water heater, 6:33251
**WINDOWS**
**Research Programs**
Energy-efficient windows program, 6:33453 (LBL—11985)
**Systems Analysis**
Energy-efficient windows program, 6:33453 (LBL—11985)
**WINKLER PROCESS**
**Comparative Evaluations**
Low/medium-Btu coal-gasification assessment of central plant for the city of Philadelphia, Pennsylvania, 6:32836 (DOE/RA/20222—2)
**WISCONSIN**
**Geochemical Surveys**
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**WOOD**
**Harvesting**
Assessment of wood-chipping machinery for harvesting non-commercial timber in New England, 6:33106 (DOE/ET/20077—T1)
**Resource Assessment**
Wood resources and utilization patterns in the North Central Region and energy needs for the manufacture of wood products, 6:33114 (MASEC/R—81-005)
**WOOD BURNING APPLIANCES**
*See also WOOD BURNING FURNACES*
**Environmental Impacts**
Assessment methodology for the air quality impact of residential wood burning, 6:33445 (BNL—29763)
**WOOD BURNING FURNACES**
**Environmental Impacts**
Assessment of the long-range transport of residential woodstove fine-particulate emissions for two future United States energy scenarios, 6:33761 (PNL-SA—9606)
**WOOD FUELS**
**Combustion**
Assessment methodology for the air quality impact of residential wood burning, 6:33445 (BNL—29763)
**Market**
Assessment of wood-chipping machinery for harvesting non-commercial timber in New England, 6:33106 (DOE/ET/20077—T1)
**WORKERS**
*See PERSONNEL*
**WYOMING**
**Geochemical Surveys**
Geochemical exploration for uranium in the Red Desert, Wyoming, 6:33001 (GJBX—125(81))

## X

**XENON**
**Excited States**
Radiative lifetime of the 6p $^4P^0$/sub 5/2/ level in Xe II, 6:33955 (CONF-810868—1)
**XI PARTICLES**
**Particle Production**
Progress report, October 1, 1980-June 30, 1981, 6:33966 (DOE/ER/03509—T1)
**XP CELLS**
**Sensitivity**
Sensitivity of excision repair in normal human, xeroderma pigmentosum variant and Cockayne's syndrome fibroblasts to inhibition by cytosine arabinoside, 6:33893
**X-RAY EMISSION ANALYSIS**
*See also X-RAY FLUORESCENCE ANALYSIS*
**Sensitivity**
Application of PIXE and INAA to biological materials: analysis of serum and serum albumin, 6:33844 (CONF-800433—)
**X-RAY EQUIPMENT**
*See also X-RAY SOURCES*
**Mirrors**
Applications of bent cylindrical mirrors to x-ray beamlines, 6:33687 (BNL—29940)
**Windows**
Fabricating thin beryllium windows for X-ray applications, 6:33706
**X-RAY FLUORESCENCE ANALYSIS**
**Design**
Ultra-sensitive trace element analysis of environmental samples using advanced TRXRF techniques, 6:33815 (CONF-800433—)
**X-RAY SOURCES**
Laser heated gas-jet: a soft x-ray source, 6:34061 (KMSF-U—1109)
**X-RAY SPECTRA**
**Least Square Fit**
Least squares method for analyzing broadened X-ray line shapes, 6:34050
**X-RAY SPECTROMETERS**
**Performance**
Hyper-filter-fluorescer spectrometer for fusion x-ray diagnostics, 6:34073 (UCRL—86163)
**XYLENES**
**Liquid Column Chromatography**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)
**NMR Spectra**
Development and application of analytical techniques to chemistry of donor solvent liquefaction. Quarterly progress report, January-March 1981, 6:32832 (DOE/PC/30041—T5)

## Y

**YTTERBIUM**
**Activation Analysis**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**Separation Processes**
Precise trace rare earth analysis by radiochemical neutron activation, 6:33581 (PNL-SA—9143)
**YTTRIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**Mass Spectroscopy**
Inductively coupled plasma as an ion source for the determination of trace elements in solutions by mass spectrometry, 6:33574 (IS-T—898)

## Z

**ZEA MAYS**
*See MAIZE*
**ZEBRA REACTOR**
**Reactor Kinetics**
ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)
**ZEOLITES**
**Radiolysis**
Effects of high radiation doses on Linde Ion Siv IE-95, 6:33028 (DP-MS—81-18)
**ZERO ENERGY BREEDER REACTOR ASSEMBLY**
*See ZEBRA REACTOR*
**ZINC**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**ZINC ALLOYS**
**Diffusion**
Zero-flux planes and flux reversals in multicomponent diffusion. Progress report, January 1, 1981-August 31, 1981 (Cu-Ni-Zn; Fe-Ni-Cr), 6:33508 (DOE/ER/10814—1)
**ZINC ORES**
**Activation Analysis**
Instrumental photon activation analysis of Cd and Pb in zinc ores, with a rotating device for intermittent irradiations, 6:33792 (CONF-800433—)
**Multi-Element Analysis**
Instrumental photon activation analysis of Cd and Pb in zinc ores, with a rotating device for intermittent irradiations, 6:33792 (CONF-800433—)
**ZINC SULFATES**
**Decomposition**
Solar furnace study of zinc sulfate decomposition, 6:33076 (UCRL—86622)
**ZIRCALOY 2**
**Chemical Radiation Effects**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Corrosion**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**ZIRCONATES**
**Photosensitivity**
Effects of ion implantation on the photoferroelectric properties of lead lanthanum zirconate titanate ceramics, 6:33561 (SAND—81-1834C)
**ZIRCONIUM**
**Emission Spectroscopy**
Hydrogeochemical and stream sediment reconnaissance basic data for Barrow Quadrangle, Alaska, 6:33007 (GJBX—272-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Misheguk Mountain Quadrangle, Alaska, 6:33009 (GJBX—276-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Watertown NTMS Quadrangle, South Dakota; Minnesota, 6:33003 (GJBX—219-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Unalakleet Quadrangle, Alaska, 6:33010 (GJBX—277-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Petersburg Quadrangle, Alaska, 6:33011 (GJBX—278-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Sagavanirktok Quadrangle, Alaska, 6:33012 (GJBX—279-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Ikpikpuk River Quadrangle, Alaska, 6:33008 (GJBX—275-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Lincoln NTMS quadrangle, Nebraska; Kansas, 6:33004 (GJBX—229-81)
Hydrogeochemical and stream sediment reconnaissance basic data for Escanaba quadrangle, Michigan; Wisconsin, 6:33002 (GJBX—218-81)
**ZIRCONIUM 90 TARGET**
**Proton Reactions**
Energy systematics of the giant Gamow-Teller resonance and a charge-exchange dipole spin-flip resonance, 6:34020

**ZIRCONIUM ALLOYS**
*See also ZIRCONIUM BASE ALLOYS*
**Physical Radiation Effects**
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
**Swelling**
Swelling of several commercial alloys following high fluence neutron irradiation, 6:33513 (HEDL-SA—2341)
**ZIRCONIUM BASE ALLOYS**
**Chemical Radiation Effects**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**Corrosion**
Review of corrosion phenomena on zirconium alloys, niobium, titanium, Inconel, stainless steel and nickel plate under irradiation, 6:33544
**ZIRCONIUM HYDRIDES**
**Hydrogen Storage**
Queries concerning local models for hydrogen uptake in metal hydrides, 6:33592
**Phase Transformations**
Queries concerning local models for hydrogen uptake in metal hydrides, 6:33592
**ZIRCONIUM OXIDES**
**Thermal Conductivity**
Thermal conductivity measurements of insulators for fusion blankets, 6:33498 (BNL—29779)
**ZPPR REACTOR**
**Reactor Kinetics**
ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)
**ZPR-3 REACTOR**
**Reactor Kinetics**
ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)
**ZPR-6 REACTOR**
**Earthquakes**
Seismic analysis of ZPR-6 reactor facility, 6:33339
**Reactor Kinetics**
ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)
**Scram**
Seismic analysis of ZPR-6 reactor facility, 6:33339
**ZPR-9 REACTOR**
**Reactor Kinetics**
ENDF/B-V, LIB-V, and the CSEWG benchmarks, 6:33323 (LA—8950-MS)

# CONTRACT NUMBER INDEX

Numbers assigned to DOE contracts under which reports announced in this publication were prepared are included in this index.


| *Contract No.* | *Abstract No.* | *Report No.* |
|---|---|---|
| **AC01-75ET12394** | **Southwest Research Inst., San Antonio, TX (USA)** | |
| | 6:32893 | DOE/ET/12394—T2 |
| **AC01-75ET12542** | **Missouri Univ., Columbia (USA)** | |
| | 6:32909 | DOE/ET/12542—T1 |
| **AC01-76CS20167** | **National Center for Resource Recovery, Inc., Washington, DC (USA)** | |
| | 6:33474 | DOE/CS/20167—6 |
| **AC01-76ET10145** | **Gulf Universities Research Consortium, Bellaire, TX (USA)** | |
| | 6:32967 | DOE/ET/10145—72 |
| **AC01-77ET13060** | **Conoco, Inc., Stamford, CT (USA)** | |
| | 6:32856 | DOE/ET/13060—T9(Vol.2) |
| **AC01-77ET29069** | **General Electric Co., Schenectady, NY (USA). Research and Development Center** | |
| | 6:33276 | CONF-811016—2 |
| **AC01-77QQ04038** | **Sheet Metal and Air Conditioning Contractors National Association, Vienna, VA (USA)** | |
| | 6:33165 | DOE/QQ/04038—T1 |
| **AC01-78CS54224** | **General Electric Co., Cincinnati, OH (USA). Advanced Energy Programs Dept.** | |
| | 6:33484 | DOE/CS/54224—T1-Vol.1 |
| | 6:33485 | DOE/CS/54224—T1-Vol.2 |
| **AC01-78ET10033** | **Ayers (Emory) Associates, Inc., New York (USA)** | |
| | 6:32906 | DOE/ET/10033—T2 |
| **AC01-78ET10325** | **Air Products and Chemicals, Inc., Allentown, PA (USA)** | |
| | 6:32811 | DOE/ET/10325—T11 |
| **AC01-78ET29335** | **Westinghouse Research and Development Center, Pittsburgh, PA (USA)** | |
| | 6:33277 | DOE/ET/29335—T1 |
| **AC01-79CS30027** | **Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.** | |
| | 6:33092 | SOLAR/0020—81/44 |
| | 6:33187 | SOLAR/1041—81/14 |
| | 6:33188 | SOLAR/1045—80/14 |
| | 6:33189 | SOLAR/1060—81/14 |
| | 6:33190 | SOLAR/2008—81/14 |
| **AC01-79ET11268** | **Skelly and Loy, Harrisburg, PA (USA)** | |
| | 6:32907 | DOE/ET/11268—T3 |
| **AC01-79ET14674** | **Bell Aerospace Textron, Buffalo, NY (USA)** | |
| | 6:32812 | DOE/ET/14674—16 |
| **AC01-79ET14693** | **North Carolina Univ., Chapel Hill (USA). Dept. of Geology** | |
| | 6:32898 | DOE/ET/14693—T3 |
| **AC01-79ET14696** | **Minnesota Gas Co., Minneapolis (USA)** | |
| | 6:33081 | DOE/ET/14696—T6 |
| **AC01-79ET14700** | **Utah Univ., Salt Lake City (USA). Dept. of Mining and Fuels Engineering** | |
| | 6:32813 | DOE/ET/14700—1 |
| **AC01-79ET15299** | **Minnesota Univ., St. Paul (USA)** | |
| | 6:32923 | DOE/ET/15299—T1 |
| **AC01-79RA20029** | **Boston Coll., Weston, MA (USA). Weston Observatory** | |
| | 6:32899 | DOE/RA/20029—T1 |
| **AC01-80EI10612** | **Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)** | |
| | 6:33390 | DOE/EIA/10612—T26 |
| | 6:33419 | DOE/EIA/10612—T26-Apps.B-C |
| **AC01-80ET32075** | **Teledyne Energy Systems, Timonium, MD (USA)** | |
| | 6:33562 | TES—32075-107 |
| **AC01-80MI01006** | **Cardinal Management Associates, Inc., Washington, DC (USA)** | |
| | 6:32980 | DOE/MI/01006—T1-Pt.1 |
| | 6:32981 | DOE/MI/01006—T1-Pt.2 |
| **AC01-81EV10450** | **Aerospace Corp., Germantown, MD (USA)** | |
| | 6:33840 | DOE/EP—0028 |
| **AC02-81ER-10814** | **Purdue Univ., Lafayette, IN (USA). School of Materials Engineering** | |
| | 6:33508 | DOE/ER/10814—1 |
| **AC02-76CH00016** | **Brookhaven National Lab., Upton, NY (USA)** | |
| | 6:32805 | BNL—22952 |
| | 6:32806 | BNL—29953 |
| | 6:32865 | BNL—24786 |
| | 6:33158 | BNL—29970 |
| | 6:33159 | BNL—51394 |
| | 6:33318 | BNL—29899 |
| | 6:33377 | BNL—51370 |
| | 6:33387 | BNL—29857 |
| | 6:33398 | BNL—51330 |
| | 6:33445 | BNL—29763 |
| | 6:33446 | BNL—51321 |
| | 6:33464 | BNL—29880 |
| | 6:33483 | BNL—51381 |
| | 6:33498 | BNL—29779 |
| | 6:33499 | BNL—29941 |
| | 6:33500 | BNL—30016 |
| | 6:33501 | BNL—30018 |
| | 6:33502 | BNL—30019 |
| | 6:33605 | BNL—29817 |
| | 6:33630 | BNL—30012 |
| | 6:33631 | BNL—51369 |
| | 6:33669 | BNL—29990 |
| | 6:33678 | BNL—30005 |
| | 6:33679 | BNL—30006 |
| | 6:33680 | BNL—30008 |
| | 6:33681 | BNL—30009 |
| | 6:33682 | BNL—30010 |
| | 6:33683 | BNL—30011 |
| | 6:33684 | BNL—30013 |
| | 6:33686 | BNL—29923 |
| | 6:33687 | BNL—29940 |
| | 6:33688 | BNL—30031 |
| | 6:33725 | BNL—51378 |
| | 6:33770 | BNL—51389 |
| | 6:33795 | BNL—29762 |
| | 6:33809 | BNL—51396 |
| | 6:33858 | BNL—29733 |
| | 6:33953 | BNL—29798 |
| | 6:33965 | BNL—30026 |
| | 6:33985 | BNL—29768 |
| | 6:33986 | BNL—29823 |
| | 6:33987 | BNL—29840 |
| | 6:34017 | BNL—29690 |
| | 6:34018 | BNL—29949 |
| | 6:34036 | BNL—29922 |
| | 6:34037 | BNL—30004 |
| | 6:34038 | BNL-NCS—51346 |
| | 6:34039 | BNL-NCS—51388 |
| | 6:34043 | BNL—30037 |
| | 6:34201 | BNL-NCS—51364 |
| **AC02-76CH03073** | **Princeton Univ., NJ (USA). Plasma Physics Lab.** | |
| | 6:34066 | PPPL—1814 |
| | 6:34067 | PPPL—1829 |
| | 6:34068 | PPPL—1830 |
| | 6:34069 | PPPL—1831 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| | 6:34182 | PPPL—1832 |
| **AC02-76ER01198** | **Illinois Univ., Urbana (USA)** | |
| | 6:33557 | DOE/ER/01198—1354 |
| | 6:33558 | DOE/ER/01198—1367 |
| **AC02-76ER03023** | **Tufts Univ., Medford, MA (USA). Dept. of Physics** | |
| | 6:33988 | DOE/ER/03023—T1 |
| **AC02-76ET20279** | **Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.** | |
| | 6:33094 | MIT-EL—79-032-Vol.1 |
| | 6:33095 | MIT-EL—79-033-Vol.2 |
| | 6:33097 | MIT-EL—80-028 |
| | 6:33099 | MIT-EL—79-029 |
| | 6:33100 | MIT-EL—79-030 |
| | 6:33101 | MIT-EL—79-044 |
| | 6:33102 | MIT-EL—80-007 |
| | 6:33126 | MIT-EL—79-016 |
| | 6:33127 | MIT-EL—79-026 |
| | 6:33128 | MIT-EL—79-042 |
| | 6:33129 | MIT-EL—80-002 |
| | 6:33131 | MIT-EL—80-025 |
| | 6:33181 | MIT-EL—79-045 |
| | 6:33182 | MIT-EL—80-024 |
| **AC02-76EV03214** | **Iceland Univ., Reykjavik** | |
| | 6:33859 | DOE/EV/03214—T3 |
| **AC02-77CH00178** | **Solar Energy Research Inst., Golden, CO (USA)** | |
| | 6:33091 | SERI/TP—351-508 |
| | 6:33096 | SERI/TP—642-1343 |
| | 6:33117 | SERI/PR—0-9010-2 |
| | 6:33118 | SERI/PR—0-9010-3 |
| | 6:33119 | SERI/PR—9296-T1 |
| | 6:33120 | SERI/TP—233-1388 |
| | 6:33121 | SERI/TP—622-1174 |
| | 6:33157 | SERI/TP—634-1282 |
| | 6:33186 | SERI/TR—98288-1 |
| | 6:33199 | SERI/RR—641-615 |
| | 6:33202 | SERI/TP—620-1344 |
| | 6:33203 | SERI/TP—631-1163 |
| | 6:33442 | SERI/TR—332-416-Vol.2 |
| **AC02-77ET28013** | **Potomac Electric Power Co., Washington, DC (USA)** | |
| | 6:33369 | EPRI-EM—1589(Vol.9)(App.C) |
| | 6:33371 | EPRI-EM—1589(Vol.8) |
| **AC02-78CS20074** | **Minnesota Energy Agency, St. Paul (USA)** | |
| | 6:33473 | DOE/CS/20074—1 |
| **AC02-78CS34703** | **Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.** | |
| | 6:33372 | COO—4703-26 |
| **AC02-78ET21002** | **VSE Corp., Alexandria, VA (USA)** | |
| | 6:33151 | DOE/ET/21002—T19 |
| **AC02-78ET21015** | **Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.** | |
| | 6:33142 | DOE/ET/21015—9 |
| | 6:33193 | DOE/ET/21015—11 |
| **AC02-78ET34222** | **United Engineers and Constructors, Inc., Philadelphia, PA (USA)** | |
| | 6:33322 | DOE/ET/34222—1 |
| **AC02-78ET51013** | **Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center** | |
| | 6:34171 | DOE/ET/51013—6 |
| **AC02-79CS30150** | **Mid-American Solar Energy Complex, Minneapolis, MN (USA)** | |
| | 6:33114 | MASEC/R—81-005 |
| | 6:33175 | MASEC-CF—81-019 |
| | 6:33176 | MASEC-CF—81-023 |
| | 6:33177 | MASEC-CF—81-035 |
| | 6:33179 | MASEC/R—81-045 |
| | 6:33180 | MASEC/R—81-059/1 |
| **AC02-79ER10472** | **Colorado Univ., Boulder (USA)** | |
| | 6:33993 | DOE/ER/10472—1 |
| **AC02-79ET15426** | **Northern Research and Engineering Corp., Woburn, MA (USA)** | |
| | 6:33468 | DOE/ET/15426—T7 |
| **AC02-79ET27225** | **Brown Univ., Providence, RI (USA). Div. of Engineering** | |
| | 6:33226 | DOE/ET/27225—9 |
| **AC02-80CS30149** | **Northeast Solar Energy Center, Boston, MA (USA)** | |
| | 6:33183 | NESEC—9 |
| **AC02-80ET34031** | **General Electric Co., San Jose, CA (USA). Nuclear Energy Div.** | |
| | 6:33291 | DOE/ET/34031—1 |
| | 6:33292 | DOE/ET/34031—2 |
| | 6:33293 | DOE/ET/34031—3 |
| | 6:33294 | DOE/ET/34031—4 |
| | 6:33295 | DOE/ET/34031—5 |
| **AC02-80EV10318** | **Missouri Univ., Columbia (USA)** | |
| | 6:33784 | CONF-800433— |
| **AC03-76CS51175** | **Booz, Allen and Hamilton, Inc., Bethesda, MD (USA). Transportation Consulting Div.** | |
| | 6:33462 | DOE/CS/51175—T18 |
| **AC03-76ET12056** | **Stanford Univ., CA (USA). Petroleum Research Inst.** | |
| | 6:32986 | DOE/ET/12056—27 |
| **AC03-76ET12057** | **Cities Service Co., Jackson, MS (USA)** | |
| | 6:32969 | DOE/ET/12057—8 |
| **AC03-76ET28443** | **San Diego Gas and Electric Co., CA (USA)** | |
| | 6:33224 | DOE/ET/28443—T15 |
| **AC03-76ET53057** | **Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.** | |
| | 6:34070 | SAI—254-81-262-LJ |
| **AC03-76SF00515** | **Stanford Linear Accelerator Center, CA (USA)** | |
| | 6:33673 | SLAC-TN—81-5 |
| | 6:33690 | SLAC-PUB—2642 |
| | 6:33691 | SLAC-TN—81-6 |
| | 6:33970 | SLAC-PUB—2761 |
| | 6:33989 | SLAC-PUB—2776 |
| **AC03-77CS20205** | **Energy and Environmental Analysis, Inc., Arlington, VA (USA)** | |
| | 6:33447 | DOE/CS/20205—T17 |
| **AC03-77CS21693** | **Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)** | |
| | 6:33444 | CONF-7803136— |
| **AC03-77ET11448** | **Boyce Engineering International, Inc., Houston, TX (USA)** | |
| | 6:33254 | DOE/ET/11448—T1 |
| **AC03-77ET13113** | **TRW, Inc., McLean, VA (USA). Energy Systems Planning Div.** | |
| | 6:33388 | DOE/ET/13113—T2 |
| **AC03-77ET15078** | **Sante Fe Corp., Alexandria, VA (USA)** | |
| | 6:33405 | DOE/ET/15078—T9 |
| **AC03-78CS32197** | **TRW Systems Group, McLean, VA (USA)** | |
| | 6:33163 | DOE/CS/32197—T1 |
| **AC03-78CS35224** | **Rho Sigma, Inc., North Hollywood, CA (USA)** | |
| | 6:33448 | DOE/CS/35224—T1 |
| **AC03-79CS30209** | **OR/MS Dialogue, Inc., Cambridge, MA (USA)** | |
| | 6:33162 | DOE/CS/30209—T4 |
| **AC03-79ET23047** | **Exxon Research and Engineering Co., Linden, NJ (USA)** | |
| | 6:33107 | DOE/ET/23047—T2 |
| **AC03-79SF10499** | **McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)** | |
| | 6:33141 | CONF-7508108—1 |
| **AC03-79SF10748** | **Proto-Power Management Corp., Groton, CT (USA)** | |
| | 6:33300 | DOE/SF/10748—T2 |
| **AC03-80SF10800** | **Aerospace Corp., El Segundo, CA (USA)** | |
| | 6:33140 | ATR—80(7873)-4 |
| **AC03-80SF11446** | **Stephens Engineering Co., Inc., McLean, VA (USA)** | |
| | 6:33191 | DOE/SF/11446—T1 |
| **AC03-80SF11511** | **Eureka Labs., Inc., Sacramento, CA (USA)** | |
| | 6:33166 | DOE/SF/11511—T1 |
| **AC04-76DP00053** | **Mound Facility, Miamisburg, OH (USA)** | |
| | 6:33549 | MLM—2850 |
| **AC04-76DP00487** | **Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)** | |
| | 6:33711 | MHSMP—81-37 |
| | 6:33712 | MHSMP—81-38 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| **AC04-76DP00613** | **Bendix Corp., Kansas City, MO (USA)** | |
| | 6:33555 | BDX—613-2645 |
| | 6:33628 | BDX—613-2623 |
| | 6:33629 | BDX—613-2644 |
| | 6:33696 | BDX—613-2668 |
| **AC04-76DP00656** | **General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.** | |
| | 6:33069 | GEPP-TIS—587 |
| **AC04-76DP00789** | **Sandia National Labs., Albuquerque, NM (USA)** | |
| | 6:32971 | SAND—81-0043 |
| | 6:32993 | SAND—81-1128 |
| | 6:33062 | SAND—81-1051 |
| | 6:33136 | SAND—81-7014/Vol.1-2 |
| | 6:33137 | SAND—81-7014/Vol.3 |
| | 6:33138 | SAND—81-7014/Vol.4 |
| | 6:33139 | SAND—81-7014/Vol.5 |
| | 6:33146 | SAND—81-0275-Rev. |
| | 6:33147 | SAND—81-8236 |
| | 6:33185 | SAND—81-0373 |
| | 6:33195 | SAND—81-0369 |
| | 6:33196 | SAND—81-8177-Exec.Summ. |
| | 6:33197 | SAND—81-8177-Vol.1 |
| | 6:33198 | SAND—81-8177-Vol.2 |
| | 6:33201 | SAND—81-8184 |
| | 6:33230 | SAND—80-0933 |
| | 6:33240 | DOE/DP/00789—T15 |
| | 6:33338 | SAND—80-2365 |
| | 6:33491 | SAND—81-1814C |
| | 6:33533 | SAND—81-1358C |
| | 6:33550 | SAND—81-0064C |
| | 6:33552 | SAND—81-0786C |
| | 6:33560 | SAND—81-0786 |
| | 6:33561 | SAND—81-1834C |
| | 6:33639 | SAND—81-0208C |
| | 6:33657 | SAND—80-0451 |
| | 6:33658 | SAND—81-0754C |
| | 6:33700 | SAND—80-2689 |
| | 6:33701 | SAND—81-1782 |
| | 6:33713 | SAND—81-0937 |
| | 6:33920 | SAND—81-0632 |
| | 6:33921 | SAND—81-0645 |
| | 6:33932 | SAND—81-1271 |
| | 6:33959 | SAND—81-1337 |
| | 6:33964 | SAND—81-1135C |
| | 6:34046 | SAND—81-1151C |
| | 6:34183 | SAND—81-1472 |
| | 6:34184 | SAND—81-1864C |
| | 6:34195 | SAND—81-1007C |
| **AC04-76DP03533** | **Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant** | |
| | 6:33622 | RFP—3180 |
| | 6:33655 | RFP—3208 |
| | 6:33768 | RFP—2462-Add. |
| **AC04-76EV01013** | **Inhalation Toxicology Research Inst., Albuquerque, NM (USA)** | |
| | 6:32960 | LMF—85 |
| **AC04-76GJ01658** | **Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)** | |
| | 6:33024 | DOE/UMT—012 |
| | 6:33025 | DOE/UMT—012S |
| | 6:33026 | DOE/UMT—0104 |
| | 6:33027 | DOE/UMT—0104S |
| **AC04-79CS30174** | **Nevada Univ., Boulder City (USA). Desert Research Inst.** | |
| | 6:33192 | DOE/CS/30174—T2Vol.1 |
| **AC05-76ER03992** | **Texas Univ., Austin (USA). Center for Particle Theory** | |
| | 6:34049 | DOE/ER/03992—448 |
| **AC05-76ET10104** | **Pittsburg and Midway Coal Mining Co., Englewood, CO (USA)** | |
| | 6:32809 | DOE/ET/10104—8 |
| **AC05-76ET53036** | **Texas Univ., Austin (USA). Fusion Research Center** | |
| | 6:34057 | DOE/ET/53036—25 |
| **AC05-78ET13511** | **Westinghouse Electric Corp., Tampa, FL (USA). Nuclear Equipment Div.** | |
| | 6:33324 | DOE/ET/13511—T8 |
| **AC05-78ORO3054** | **International Coal Refining Co., Allentown, PA (USA)** | |
| | 6:32821 | DOE/OR/03054—3 |
| **AC06-76RL01830** | **Battelle Pacific Northwest Labs., Richland, WA (USA)** | |
| | 6:32997 | PNL-SA—9792 |
| | 6:33039 | ONWI—9-81-2 |
| | 6:33040 | PNL—3902 |
| | 6:33041 | PNL—3948 |
| | 6:33056 | PNL—3791 |
| | 6:33057 | PNL-SA—9262 |
| | 6:33068 | PNL—3839 |
| | 6:33115 | PNL-SA—9246 |
| | 6:33116 | PNL-SA—9751 |
| | 6:33135 | PNL—3853 |
| | 6:33220 | PNL—3801 |
| | 6:33234 | PNL-SA—9149 |
| | 6:33243 | PNL-SA—9411 |
| | 6:33297 | PNL-SA—9641 |
| | 6:33362 | PNL-SA—9316 |
| | 6:33370 | PNL-SA—9782 |
| | 6:33373 | DOE/RL/01830—T6 |
| | 6:33374 | PNL—3645 |
| | 6:33375 | PNL—3769 |
| | 6:33382 | PNL—3799 |
| | 6:33460 | PNL-SA—9049 |
| | 6:33530 | PNL-SA—9266 |
| | 6:33531 | PNL-SA—9446 |
| | 6:33532 | PNL-SA—9728 |
| | 6:33581 | PNL-SA—9143 |
| | 6:33591 | PNL-SA—9377 |
| | 6:33638 | PNL-SA—9635 |
| | 6:33760 | PNL-SA—8432 |
| | 6:33761 | PNL-SA—9606 |
| | 6:33767 | PNL-SA—9140 |
| | 6:33835 | PNL-SA—9419 |
| | 6:33890 | PNL-SA—9315 |
| | 6:33891 | PNL-SA—9632 |
| | 6:33913 | PNL-SA—9435 |
| | 6:33923 | PNL-SA—9478 |
| | 6:33963 | PNL-SA—9712 |
| | 6:34042 | PNL-SA—9317 |
| **AC07-76ID01375** | **Aerojet Nuclear Co., Scoville, ID (USA)** | |
| | 6:33918 | DOE/ID/01375—T1 |
| **AC07-76ID01570** | **EG and G Idaho, Inc., Idaho Falls (USA)** | |
| | 6:33089 | EGG-M—02781 |
| | 6:33225 | EGG—2110 |
| | 6:33331 | CONF-810606—71 |
| | 6:33332 | CONF-810606—72 |
| | 6:33341 | CONF-810606—73 |
| | 6:33342 | CONF-810606—74 |
| | 6:33353 | GEND—010-Vol.1 |
| **AC08-76NV01183** | **EG and G Idaho, Inc., Idaho Falls (USA)** | |
| | 6:33697 | EGG—1183-1777 |
| **AC08-78DP40030** | **KMS Fusion, Inc., Ann Arbor, MI (USA)** | |
| | 6:34061 | KMSF-U—1109 |
| **AC08-78ET11397** | **Texas Univ., Austin (USA). Bureau of Economic Geology** | |
| | 6:32990 | CONF-811026—5 |
| **AC08-79ET27111** | **Texas Univ., Austin (USA). Bureau of Economic Geology** | |
| | 6:32991 | CONF-811026—6 |
| | 6:33214 | CONF-811026—8 |
| **AC08-79ET27112** | **Texas Univ., Austin (USA). Bureau of Economic Geology** | |
| | 6:32991 | CONF-811026—6 |
| **AC08-79NV10039** | **Nevada Bureau of Mines and Geology, Reno (USA)** | |
| | 6:33207 | DOE/NV/10039—3 |
| **AC08-80NV10072** | **Gruy Federal, Inc., Arlington, VA (USA)** | |
| | 6:33206 | DOE/EV/10072—5 |
| **AC08-81NV10145** | **URS/John A. Blume and Associates, Engineers, San Francisco, CA (USA)** | |
| | 6:33632 | CONF-810742—2 |
| **AC09-76SR00001** | **Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.** | |
| | 6:33028 | DP-MS—81-18 |
| | 6:33029 | DPST—81-262 |
| | 6:33070 | DPST—80-128-4 |
| | 6:33572 | DP—1577 |
| | 6:33654 | DP-MS—81-12 |
| | 6:33801 | DPSPU—81-30-1 |
| | 6:33924 | DPST—81-262 |
| **AC09-78SR01069** | **Stoller (S.M.) Corp., New York (USA)** | |
| | 6:33018 | DOE/SR/01069—1 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| **AC09-79ET41900** | **Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group** | |
| | 6:33022 | DOE/ET/41900—5 |
| **AC11-76PN00014** | **Bettis Atomic Power Lab., West Mifflin, PA (USA)** | |
| | 6:33653 | WAPD-TM—1473 |
| **AC13-76GJ01664** | **Bendix Field Engineering Corp., Grand Junction, CO (USA)** | |
| | 6:33001 | GJBX—125(81) |
| | 6:33391 | GJBX—182(81) |
| **AC13-79GJ01692** | **High Life Helicopters, Inc., Puyallup, WA (USA)** | |
| | 6:33005 | GJBX—241-81-Vol.1 |
| **AC14-76FF02170** | **Hanford Engineering Development Lab., Richland, WA (USA)** | |
| | 6:33309 | HEDL-SA—2333-FP |
| | 6:33310 | HEDL-SA—2371 |
| | 6:33311 | HEDL-SA—2386 |
| | 6:33336 | HEDL-SA—2312-FP |
| | 6:33337 | HEDL-SA—2330-Rev.1 |
| | 6:33354 | HEDL-SA—2263-FP |
| | 6:33355 | HEDL-SA—2264-FP |
| | 6:33356 | HEDL-SA—2272 |
| | 6:33357 | HEDL-SA—2284-FP |
| | 6:33358 | HEDL-SA—2288-S |
| | 6:33359 | HEDL-SA—2292-FP |
| | 6:33511 | HEDL-SA—2317 |
| | 6:33512 | HEDL-SA—2338-FP |
| | 6:33513 | HEDL-SA—2341 |
| | 6:33514 | HEDL-SA—2342-FP |
| | 6:33515 | HEDL-SA—2357 |
| | 6:33516 | HEDL-SA—2359 |
| | 6:33517 | HEDL-SA—2475 |
| | 6:33635 | HEDL-SA—2201-FP |
| | 6:34173 | HEDL-SA—2340FP |
| | 6:34174 | HEDL-SA—2476-FP |
| **AC15-76CL02395** | **Department of Energy, Oak Ridge, TN (USA). Technical Information Center** | |
| | 6:33302 | CONF-810941—1 |
| **AC18-80FC10193** | **Acurex Corp., Research Triangle Park, NC (USA)** | |
| | 6:33742 | DOE/FC/10193—T1 |
| **AC21-76ET10593** | **Western Michigan Univ., Kalamazoo (USA). Dept. of Chemistry** | |
| | 6:32944 | DOE/ET/10593—T2 |
| **AC21-77ET10415** | **Minnick (L. John), Plymouth Meeting, PA (USA)** | |
| | 6:33466 | DOE/ET/10415—T4 |
| **AC21-79MC11577** | **SRI International, Menlo Park, CA (USA)** | |
| | 6:32992 | DOE/MC/11577—T23 |
| **AC21-80MC14784** | **Zawadzki (Edward A.) Ltd., McMurray, PA (USA)** | |
| | 6:32866 | DOE/MC/14784—T1 |
| **AC22-70ET14700** | **Utah Univ., Salt Lake City (USA). Dept. of Mining and Fuels Engineering** | |
| | 6:32814 | DOE/ET/14700—2 |
| **AC22-76ET10154** | **Southern Co. Services, Inc., Birmingham, AL (USA)** | |
| | 6:32810 | DOE/ET/10154—T14 |
| **AC22-78ET11343** | **Aerojet Energy Conversion Co., Sacramento, CA (USA)** | |
| | 6:33467 | DOE/ET/11343—T2 |
| **AC22-79ET14855** | **SRI International, Menlo Park, CA (USA)** | |
| | 6:32815 | DOE/ET/14855—6 |
| | 6:32816 | DOE/ET/14855—9 |
| | 6:32817 | DOE/ET/14855—12 |
| **AC22-79ET14943** | **Cities Service Research and Development Co., Tulsa, OK (USA). Cities Service Technical Center** | |
| | 6:32818 | DOE/ET/14943—T1 |
| **AC22-80PC30021** | **Air Products and Chemicals, Inc., Allentown, PA (USA)** | |
| | 6:32831 | DOE/PC/30021—T4 |
| **AC22-80PC30041** | **Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)** | |
| | 6:32832 | DOE/PC/30041—T5 |
| | 6:32833 | DOE/PC/30041—T6 |
| **AC22-80PC30080** | **Gulf Research and Development Co., Pittsburgh, PA (USA)** | |
| | 6:32834 | DOE/PC/30080—4 |
| **AC22-80PC30295** | **Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.** | |
| | 6:32945 | DOE/PC/30295—3 |
| **AC22-80PC30298** | **Energy and Environmental Research Corp., Santa Ana, CA (USA)** | |
| | 6:33743 | DOE/PC/30298—T3 |
| **AC22-80PC30301** | **Battelle Columbus Labs., OH (USA)** | |
| | 6:32946 | DOE/PC/30301—3 |
| **AC22-80PC30304** | **Aerochem Research Labs., Inc., Princeton, NJ (USA)** | |
| | 6:33083 | DOE/PC/30304—2 |
| **AC22-80PC30307** | **Gulf Science and Technology Co., Pittsburgh, PA (USA). Chemical and Minerals Div.** | |
| | 6:32947 | DOE/PC/30307—3 |
| **AC22-81PC40266** | **Babcock and Wilcox Co., Alliance, OH (USA). Research Center** | |
| | 6:32859 | DOE/PC/40266—1 |
| **AC22-81PC40787** | **Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering** | |
| | 6:32860 | DOE/PC/40787—1 |
| **AI01-76ET20320** | **Massachusetts Inst. of Tech., Cambridge (USA). Aeroelastic and Structures Research Lab.** | |
| | 6:33241 | DOE/NASA/3303—1 |
| **AI01-76PR06010** | **National Bureau of Standards, Washington, DC (USA). Center for Materials Science** | |
| | 6:32835 | DOE/PR/06010—T7 |
| **AI01-77CS51040** | **National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center** | |
| | 6:33487 | DOE/NASA/51040—22 |
| | 6:33490 | DOE/NASA/51040—31 |
| **AI01-77ET10350** | **National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center** | |
| | 6:33509 | DOE/NASA/2593—22 |
| **AI01-77ET10769** | **Avco-Everett Research Lab., Inc., Everett, MA (USA)** | |
| | 6:33435 | DOE/NASA/0051—2 |
| **AI01-77ET13111** | **National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center** | |
| | 6:33438 | DOE/NASA/1062—9 |
| **AI01-78CS35217** | **Department of the Air Force, Los Angeles, CA (USA)** | |
| | 6:33373 | DOE/RL/01830—T6 |
| **AI01-80ET14356** | **Army Cold Regions Research and Engineering Lab., Hanover, NH (USA)** | |
| | 6:33404 | DOE/ET/14356—T1 |
| **AI01-80ET17088** | **Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center** | |
| | 6:33439 | DOE/NASA/0161—7 |
| | 6:33440 | DOE/NASA/0176—81/2 |
| **AI03-76ER72008** | **California Inst. of Tech., Pasadena (USA)** | |
| | 6:33588 | CALT—767P8-8 |
| **AI04-80AL12726** | **National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center** | |
| | 6:33441 | DOE/NASA/12726—13 |
| **AI08-76DP00539** | **Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.** | |
| | 6:33802 | EPA/600—4-81-047 |
| **AM01-76EI02295** | **Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.** | |
| | 6:33098 | MIT-EL—81-012 |
| | 6:33130 | MIT-EL—80-008 |
| | 6:33132 | MIT-EL—81-004 |
| **AM01-77ET12532** | **Ketron, Inc., Wayne, PA (USA)** | |
| | 6:32908 | DOE/ET/12532—T4 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| **AM06-76RL02227** | **Oregon State Univ., Newport (USA). Marine Science Center** | |
| | 6:33827 | DOE/EV/10251—3 |
| | 6:33994 | DOE/ER/70035—4 |
| **AS01-78CS40087** | **Cornell Univ., Geneva, NY (USA). Inst. of Food Science** | |
| | 6:33465 | DOE/CS/40087—T1 |
| **AS02-76ER01367** | **Northwestern Univ., Evanston, IL (USA). Dept. of Materials Science and Engineering** | |
| | 6:33504 | CONF-810391—1 |
| **AS02-76ER02696** | **Denison Univ., Granville, OH (USA)** | |
| | 6:33991 | DOE/ER/02696—11 |
| **AS02-76ER02853** | **Massachusetts Univ., Amherst (USA)** | |
| | 6:34000 | DOE/ER/02853—T1 |
| **AS02-76ER03158** | **Cornell Univ., Ithaca, NY (USA). Materials Science Center** | |
| | 6:33956 | DOE/ER/03158—93 |
| **AS02-76ET28359** | **Denver Research Inst., CO (USA)** | |
| | 6:33227 | DOE/ET/28359—T1 |
| **AS02-76ET37227** | **Wisconsin Univ., Madison (USA). Dept. of Mechanical Engineering and Statistics** | |
| | 6:33344 | DOE/ET/37227—T1 |
| | 6:33345 | DOE/ET/37227—T2 |
| | 6:33346 | DOE/ET/37227—T4 |
| **AS02-76ET37240** | **Massachusetts Inst. of Tech., Cambridge (USA)** | |
| | 6:33304 | DOE/ET/37240—74TR |
| **AS02-76EV02428** | **Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.** | |
| | 6:33271 | MIT-EL—80-033 |
| **AS02-77ER04195** | **Vassar Coll., Poughkeepsie, NY (USA)** | |
| | 6:33967 | DOE/ER/04195—5 |
| **AS02-77ER04215** | **Minnesota Univ., Minneapolis (USA)** | |
| | 6:33992 | DOE/ER/04215—5 |
| **AS02-78ER04660** | **Pennsylvania Univ., Philadelphia (USA)** | |
| | 6:33968 | DOE/ER/04660—1 |
| **AS02-78ET20483** | **Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.** | |
| | 6:33155 | MIT-EL—79-041 |
| **AS02-78ET20512** | **Gulf Coast Research Lab., Ocean Springs, MS (USA)** | |
| | 6:33909 | DOE/ET/20512—T1 |
| **AS02-78EV04969** | **Massachusetts Inst. of Tech., Cambridge (USA)** | |
| | 6:33689 | DOE/EV/04969—3 |
| **AS02-79CS20321** | **Indianapolis Center for Advanced Research, IN (USA)** | |
| | 6:33476 | DOE/CS/20321—1 |
| **AS02-79ER10345** | **Pennsylvania State Univ., University Park (USA)** | |
| | 6:33080 | DOE/ER/10345—2 |
| **AS05-76ER03509** | **Florida State Univ., Tallahassee (USA). Dept. of Physics** | |
| | 6:33966 | DOE/ER/03509—T1 |
| **AS05-76EV03728** | **Louisiana State Univ., Baton Rouge (USA). Dept. of Zoology and Physiology** | |
| | 6:33887 | DOE/EV/03728—T1 |
| **AS05-76OR90337** | **West Virginia Univ., Morgantown (USA)** | |
| | 6:33368 | DOE/OR/90337—T1 |
| **AS05-77ET12038** | **University of Southern Mississippi, Hattiesburg (USA). Dept. of Polymer Science** | |
| | 6:32968 | DOE/ET/12038—T3 |
| **AS05-78OR06074** | **Piedmont Engineers, Greenville, SC (USA)** | |
| | 6:33335 | DOE/OR/06074—1-Vol.3 |
| **AS05-81EV10539** | **Maryland Univ., College Park (USA). Dept. of Meteorology** | |
| | 6:33721 | DOE/EV/10539—T1 |
| **AS09-79SR10018** | **Charles County Community Coll., La Plata, MD (USA)** | |
| | 6:33807 | DOE/SR/10018—5 |
| **AS09-80SR10706** | **Clemson Univ., SC (USA). Dept. of Forestry** | |
| | 6:33886 | DOE/SR/10706—1 |
| **AT03-76ET51011** | **General Atomic Co., San Diego, CA (USA)** | |
| | 6:34058 | GA-A—16400 |
| | 6:34059 | GA-A—16418 |
| | 6:34060 | GA-A—16441 |
| | 6:34172 | GA-A—16384 |
| **AT03-76EV74010** | **Aerospace Corp., Germantown, MD (USA)** | |
| | 6:33839 | DOE/EP—0026 |
| | 6:33840 | DOE/EP—0028 |
| **AT03-76SF70097** | **SRI International, Menlo Park, CA (USA)** | |
| | 6:33347 | DOE/SF/70097—T8 |
| **AT03-76SF71031** | **General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.** | |
| | 6:33308 | GEFR-SP—236 |
| **AT06-76EV70024** | **Washington Univ., Seattle (USA). Dept. of Oceanography** | |
| | 6:33820 | DOE/EV/70024—44 |
| **AT06-76RL01830** | **Battelle Pacific Northwest Labs., Richland, WA (USA)** | |
| | 6:33804 | PNL—3616 |
| **AT06-79EV10251** | **Oregon State Univ., Newport (USA). Marine Science Center** | |
| | 6:33888 | DOE/EV/10251—4 |
| **AT06-RL10119** | **Washington State Univ., Pullman (USA). Coll. of Engineering** | |
| | 6:33023 | DOE/RL/10119—1 |
| **FC01-78CS05205** | **Portsmouth Public Schools, VA (USA)** | |
| | 6:33164 | DOE/NASA/CR—161830 |
| **FC03-80SF10852** | **Colorado School of Mines, Golden (USA). Research Inst.** | |
| | 6:32996 | DOE/SF/10852—T1 |
| **FG01-78ET20077** | **Massachusetts Univ., Amherst (USA)** | |
| | 6:33106 | DOE/ET/20077—T1 |
| **FG01-79CS20243** | **Alabama Energy Management Board, Montgomery (USA)** | |
| | 6:33475 | DOE/CS/20243—1 |
| **FG01-79ET14692** | **Minnesota Dept. of Natural Resources, St. Paul (USA)** | |
| | 6:32896 | DOE/ET/14692—T2App.A-D |
| | 6:32897 | DOE/ET/14692—T2App.E |
| | 6:32902 | DOE/ET/14692—T1 |
| **FG01-79RA20219** | **Boeing Co., Seattle, WA (USA). Boeing Engineering and Construction Div.** | |
| | 6:33082 | DOE/FE/20219—2 |
| **FG01-79RA20222** | **Philadelphia Gas Works, PA (USA)** | |
| | 6:32836 | DOE/RA/20222—2 |
| **FG02-80R510223** | **Indiana Laborers' Training Trust Fund, Bedford (USA)** | |
| | 6:33194 | DOE/R5/10223—2 |
| **FG02-80R510226** | **Amon Cherrywood Farms, Williamsburg, MI (USA)** | |
| | 6:33242 | DOE/R5/10226—1 |
| **FG03-78ET27167** | **California Energy Resources Conservation and Development Commission, Sacramento (USA)** | |
| | 6:33205 | DOE/ET/27167—T1 |
| **FG05-77ER05518** | **Florida Inst. of Tech., Melbourne (USA)** | |
| | 6:33150 | DOE/ER/05518—1 |
| **FG05-77ET20347** | **Arkansas Univ., Fayetteville (USA)** | |
| | 6:33124 | DOE/ET/20347—T1 |
| **FG22-80PC30233** | **Illinois Univ., Urbana (USA). Dept. of Civil Engineering** | |
| | 6:32867 | DOE/PC/30233—T2 |
| **NAS-7-100-5101** | **Jet Propulsion Lab., Pasadena, CA (USA)** | |
| | 6:33108 | DOE/JPL—1012-78/11 |
| **NAS-7-100-954334** | **Union Carbide Corp., Sistersville, WV (USA)** | |
| | 6:33109 | DOE/JPL/954334—19 |
| **NAS-7-100-954355** | **Mobil Tyco Solar Energy Corp., Waltham, MA (USA)** | |
| | 6:33110 | DOE/JPL/954355—81-18 |
| **NAS-7-100-955089** | **Optical Coating Lab., Inc., City of Industry, CA (USA). Photoelectronics Div.** | |
| | 6:33111 | DOE/JPL/955089—81/11 |
| **NAS-7-100-955733** | **Kayex Corp., Rochester, NY (USA)** | |
| | 6:33112 | DOE/JPL/955733—T1 |
| **NAS-7-100-955894** | **General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.** | |
| | 6:33125 | DOE/JPL/955894—2 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| **NAS-7-100-955902** | **Solarex Corp., Rockville, MD (USA)** | |
| | 6:33113 | DOE/JPL/955902—81/2 |
| **W-31-109-ENG-38** | **Argonne National Lab., IL (USA)** | |
| | 6:32804 | ANL—81-30 |
| | 6:32880 | ANL/LRP-TM—20 |
| | 6:33079 | ANL/CNSV—22 |
| | 6:33149 | ANL/OTEC-BCM—018 |
| | 6:33161 | CONF-811034—1 |
| | 6:33252 | ANL/FE—81-55 |
| | 6:33269 | ANL/CEN/FE—81-1 |
| | 6:33301 | ANL—81-18 |
| | 6:33303 | CONF-8008111—1 |
| | 6:33376 | ANL—81-14 |
| **W-7405-ENG-26** | **Oak Ridge National Lab., TN (USA)** | |
| | 6:32803 | ORNL/TM—7960 |
| | 6:32808 | CONF-810914—6 |
| | 6:32841 | ORNL/TM—7664 |
| | 6:32857 | CONF-810914—5 |
| | 6:32948 | ORNL/TM—7724 |
| | 6:32999 | ORNL/CSD/TM—155-Vol.1 |
| | 6:33002 | GJBX—218-81 |
| | 6:33003 | GJBX—219-81 |
| | 6:33004 | GJBX—229-81 |
| | 6:33006 | GJBX—243-81 |
| | 6:33007 | GJBX—272-81 |
| | 6:33008 | GJBX—275-81 |
| | 6:33009 | GJBX—276-81 |
| | 6:33010 | GJBX—277-81 |
| | 6:33011 | GJBX—278-81 |
| | 6:33012 | GJBX—279-81 |
| | 6:33020 | ORNL-tr—4777 |
| | 6:33046 | K/SUB—13876-81/1 |
| | 6:33156 | ORNL/TM—7438-Vol.2 |
| | 6:33253 | CONF-810946—1 |
| | 6:33264 | ORNL/Sub—7399/1 |
| | 6:33265 | ORNL/TM—7847 |
| | 6:33312 | ORNL/CSD/TM—126 |
| | 6:33343 | CONF-810806—8 |
| | 6:33361 | ORNL/TM—7980 |
| | 6:33392 | ORNL/Sub—80/40416/1 |
| | 6:33427 | ORNL/TM—7863 |
| | 6:33459 | ORNL/CON—59 |
| | 6:33471 | ORNL/TM—7852 |
| | 6:33479 | ORNL/TM—7757 |
| | 6:33495 | CONF-800804—43 |
| | 6:33505 | CONF-810831—11 |
| | 6:33506 | CONF-810866—1(Draft) |
| | 6:33507 | CONF-810943—2 |
| | 6:33529 | ORNL/TM—7970 |
| | 6:33534 | Y/DV—134 |
| | 6:33545 | CONF-810851—2 |
| | 6:33546 | CONF-810856—1 |
| | 6:33556 | CONF-810801—57 |
| | 6:33576 | K/OA—5014-Rev.1 |
| | 6:33606 | CONF-810914—4 |
| | 6:33633 | CONF-810835—12 |
| | 6:33642 | Y—2227 |
| | 6:33643 | Y/IA—152 |
| | 6:33670 | CONF-810944—1 |
| | 6:33672 | ORNL/TM—7886 |
| | 6:33769 | ORNL/TM—7744 |
| | 6:33803 | ORNL/TM—7858 |
| | 6:33889 | ORNL—5692 |
| | 6:33908 | CONF-8009172—1 |
| | 6:33912 | ORNL—5721 |
| | 6:33919 | K/RA—106 |
| | 6:33954 | CONF-800859—8 |
| | 6:33955 | CONF-810868—1 |
| | 6:34019 | ORNL/TM—7295 |
| | 6:34028 | ORNL/TM—7883 |
| | 6:34047 | CONF-800877—3 |
| | 6:34056 | CONF-810831—52 |
| | 6:34063 | ORNL/CSD/TM—157 |
| | 6:34064 | ORNL/TM—7001 |
| | 6:34065 | ORNL/TM—7857 |
| | 6:34181 | ORNL/TM—7879 |
| | 6:34194 | ORNL/CSD—79 |
| **W-7405-ENG-36** | **Los Alamos National Lab., NM (USA)** | |
| | 6:32987 | LA-UR—81-2622 |
| | 6:32995 | LA—8792-MS |
| | 6:33013 | LA—6647-MS |
| | 6:33014 | LA—8807-MS |
| | 6:33015 | LA-UR—81-2451 |
| | 6:33016 | LA-UR—81-1821 |
| | 6:33035 | LA—8861-UMT |
| | 6:33036 | LA—8967-PR |
| | 6:33037 | LA-UR—81-2584 |
| | 6:33060 | LA—8621-MS |
| | 6:33061 | LA—8969-MS |
| | 6:33071 | LA—8904-PR |
| | 6:33072 | LA—8968-PR |
| | 6:33073 | LA-UR—81-2477 |
| | 6:33074 | LA-UR—81-2628 |
| | 6:33170 | LA-UR—81-2500 |
| | 6:33171 | LA-UR—81-2518 |
| | 6:33218 | LA-UR—81-1765 |
| | 6:33219 | LA-UR—81-1807 |
| | 6:33228 | LA—8855-HDR |
| | 6:33229 | LA—8954-MS |
| | 6:33317 | LA-UR—81-2595 |
| | 6:33323 | LA—8950-MS |
| | 6:33360 | LA—8971-MS |
| | 6:33521 | LA-UR—81-2426 |
| | 6:33522 | LA-UR—81-2437 |
| | 6:33523 | LA-UR—81-2444 |
| | 6:33524 | LA-UR—81-2455 |
| | 6:33525 | LA-UR—81-2456 |
| | 6:33577 | LA—8957-MS |
| | 6:33578 | LA-UR—81-2531 |
| | 6:33619 | LA-UR—81-2530 |
| | 6:33636 | LA—8894-MS |
| | 6:33646 | LA-tr—81-19 |
| | 6:33648 | LA-UR—81-2568 |
| | 6:33671 | LA-UR—81-2571 |
| | 6:33698 | LA—8720 |
| | 6:33708 | LA—8930-MS |
| | 6:33709 | LA-UR—81-1835 |
| | 6:33710 | LA-UR—81-2482 |
| | 6:33718 | LA-tr—81-23 |
| | 6:33745 | LA—8938-MS |
| | 6:33934 | LA-UR—81-2505 |
| | 6:33935 | LA-UR—81-2575 |
| | 6:33936 | LA-UR—81-2591 |
| | 6:33957 | LA-UR—81-2473 |
| | 6:33962 | LALP—81-29 |
| | 6:33983 | LA-UR—81-2635 |
| | 6:33995 | LA-UR—81-2410 |
| | 6:33997 | LA—8937-T |
| | 6:34044 | LA—8921-MS |
| | 6:34062 | LA-UR—81-2572 |
| | 6:34175 | LA—8114-PR |
| | 6:34176 | LA-UR—81-2468 |
| | 6:34177 | LA-UR—81-2469 |
| | 6:34178 | LA-UR—81-2523 |
| | 6:34179 | LA-UR—81-2524 |
| **W-7405-ENG-48** | **Lawrence Livermore National Lab., CA (USA)** | |
| | 6:32842 | UCRL—50026-81-1 |
| | 6:32878 | LBL—13063 |
| | 6:32994 | UCID—16986-81-2 |
| | 6:32998 | UCRL—53197 |
| | 6:33047 | LBL—11566 |
| | 6:33055 | UCRL—85553 |
| | 6:33065 | UCRL—86600 |
| | 6:33076 | UCRL—86622 |
| | 6:33077 | UCRL—86623 |
| | 6:33152 | LBL—10511-Vol.1 |
| | 6:33153 | LBL—10511-Vol.2 |
| | 6:33154 | LBL—12977 |
| | 6:33172 | LBL—11387 |
| | 6:33173 | LBL—12048 |
| | 6:33174 | LBL—13054-Rev. |
| | 6:33221 | UCRL—52980 |
| | 6:33222 | UCRL—86148 |
| | 6:33223 | UCRL—86515 |
| | 6:33298 | UCID—19104 |
| | 6:33299 | UCID—19105 |
| | 6:33380 | UCID—19178 |
| | 6:33383 | UCRL—53131 |
| | 6:33399 | LBL—6831-Rev. |
| | 6:33450 | LBL—11985 |
| | 6:33457 | LBL—12259 |
| | 6:33458 | LBL—12777 |
| | 6:33492 | UCRL—86560 |
| | 6:33496 | LBL—12000 |
| | 6:33548 | LBL—11883 |
| | 6:33563 | UCRL—15373 |
| | 6:33564 | UCRL—15375 |
| | 6:33590 | LBL—12986 |
| | 6:33621 | LBL—12441 |

| *Contract No.* | *Abstract No.* | *Report No.* |
|---|---|---|
| | 6:33626 | LBL—13178 |
| | 6:33637 | LBL—12783 |
| | 6:33641 | UCRL—85877 |
| | 6:33649 | UCRL—15348 |
| | 6:33702 | UCRL—85763-Rev.1 |
| | 6:33714 | UCRL—52903 |
| | 6:33715 | UCRL—86372 |
| | 6:33716 | UCRL—86563 |
| | 6:33719 | UCID—19164 |
| | 6:33720 | UCRL—53103 |
| | 6:33746 | LBL—11986 |
| | 6:33758 | LBL—12887 |
| | 6:33762 | UCRL—85035 |
| | 6:33766 | LBL—10769 |
| | 6:33805 | UCRL—53152-Pt.1 |
| | 6:33821 | EPRI-EA—1989 |
| | 6:33828 | UCRL—52853-Pt.1 |
| | 6:33829 | UCRL—53853-Pt.3 |
| | 6:33830 | LBL—13192 |
| | 6:33831 | LBL—13193 |
| | 6:33846 | LBL—12979 |
| | 6:33931 | LBL—12987 |
| | 6:33952 | UCID—19185 |
| | 6:33969 | LBL—12950 |
| | 6:33974 | LBL—12972 |
| | 6:34071 | UCID—19173 |
| | 6:34072 | UCRL—86162 |
| | 6:34073 | UCRL—86163 |
| | 6:34180 | LBL—12995 |
| | 6:34185 | UCID—19176 |
| | 6:34186 | UCRL—85645 |
| | 6:34193 | LBL—12370 |
| | 6:34196 | UCID—19076 |
| | 6:34197 | UCRL—85156-Rev.1 |
| | 6:34198 | UCRL—86581 |
| | 6:34202 | UCRL—85749 |
| | 6:34203 | UCRL—86143 |
| **W-7405-ENG-82** | **Ames Lab., IA (USA)** | |
| | 6:32861 | IS-M—330 |
| | 6:33059 | IS-M—337 |
| | 6:33168 | IS-M—334 |
| | 6:33169 | IS-M—345 |
| | 6:33518 | IS-M—338 |
| | 6:33519 | IS-T—918 |
| | 6:33520 | IS-T—926 |
| | 6:33559 | IS-M—329 |
| | 6:33574 | IS-T—898 |
| | 6:33575 | IS-T—914 |

# REPORT NUMBER INDEX

The numbers assigned to all reports cited in the publication appear in the first column of the index. The citation numbers are included in the second column. Cross reference information and/or availability are included as appropriate. Abbreviations used in the availability column are elaborated at the end of the index. To expedite the filling of orders for reports from NTIS and TIC, an order number in the form, DE81000001, is appended to the availability statement. Requesters are urged to use this order number where provided. Following the order number, one or more DOE distribution categories are indicated, e.g. , STD-10, MN-25. STD indicates distribution was made in full size copy; MN indicates microcopy distribution. These category numbers are included to assist DOE librarians in responding to requests for reports in their collections. The UC (Unclassified Distribution Categories) are defined in DOE/TIC-4500, available from TIC.

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| **A-** | | |
| 093692 | 6:33105 | NTIS PC A03/MF A01 |
| **AD-A-** | | |
| 092605 | 6:33664 | National Research Council, Marine Board, Washington, DC. Distribution Category MN -92a |
| **AED-EO-** | | |
| 17-Vol.1 | 6:33484 | *See* DOE/CS/54224-T1-Vol.1 |
| 17-Vol.2 | 6:33485 | *See* DOE/CS/54224-T1-Vol.2 |
| **ANL-** | | |
| 81-14 | 6:33376 | NTIS, PC A02/MF A01. Distribution Category STD -94cb |
| 81-18 | 6:33301 | NTIS, PC A03/MF A01. Order Number DE81026474, Distribution Category STD -79e |
| 81-30 | 6:32804 | NTIS, PC A03/MF A01. Order Number DE81028474, Distribution Category STD -90e |
| **ANL/CEN/FE-** | | |
| 81-1 | 6:33269 | NTIS, PC A04/MF A01. Order Number DE81030192, Distribution Category STD -90e |
| **ANL/CNSV-** | | |
| 22 | 6:33079 | NTIS, PC A02/MF A01. Order Number DE81030198, Distribution Category STD -95e |
| **ANL/FE-** | | |
| 81-55 | 6:33252 | NTIS, PC A04/MF A01. Order Number DE81030092, Distribution Category STD -90e |
| **ANL/LRP-TM-** | | |
| 20 | 6:32880 | NTIS, PC A12/MF A01. Order Number DE81029992, Distribution Category MN -88 |
| 20 | 6:32881 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32882 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32883 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32884 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32885 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32886 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32887 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32888 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:3288º | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32890 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32891 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32892 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32955 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32956 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32957 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| 20 | 6:32958 | NTIS, PC A12/MF A01. Order Number DE81029992 |
| **ANL/OTEC-BCM-** | | |
| 018 | 6:33149 | NTIS, PC A03/MF A01. Order Number DE81029953, Distribution Category STD -64 |
| **ATDL-** | | |
| 81/ 5 | 6:33724 | NTIS, PC A04/MF A01. Order Number DE81030474, Distribution Category MN -11 |
| **ATR-** | | |
| 80(7873) -4 | 6:33140 | NTIS, PC A02/MF A01. Order Number DE81027231, Distribution Category MN -62c |
| **BDX-** | | |
| 613-2623 | 6:33628 | NTIS, PC A04/MF A01. Order Number DE81030189, Distribution Category MN -38 |
| 613-2644 | 6:33629 | NTIS, PC A04/MF A01. Order Number DE81030190, Distribution Category MN -38 |
| 613-2645 | 6:33555 | NTIS, PC A02/MF A01. Order Number DE81030692, Distribution Category MN -38 |
| 613-2668 | 6:33696 | NTIS, PC A02/MF A01. Order Number DE81030691, Distribution Category MN -38 |
| **BHARC-** | | |
| 411 | 6:33382 | *See* PNL-3799 |
| **BNL-** | | |
| 22952 | 6:32805 | NTIS, PC A02/MF A01. Order Number DE81030036, Distribution Category MN -90a |
| 24786 | 6:32865 | NTIS, PC A07/MF A01. Order Number DE81030495, Distribution Category MN -90i |
| 29690 | 6:34017 | NTIS, PC A02/MF A01. Order Number DE81027306, Distribution Category MN -34C |
| 29733 | 6:33858 | NTIS, PC A02/MF A01. Order Number DE81032039, Distribution Category MN -48 |
| 29762 | 6:33795 | NTIS, PC A02/MF A01. Order Number DE81025870, Distribution Category MN -70 |
| 29763 | 6:33445 | NTIS, PC A02/MF A01. Order Number DE81029373, Distribution Category MN -95d |
| 29768 | 6:33985 | NTIS, PC A02/MF A01. Order Number DE81025808, Distribution Category MN -34D |
| 29779 | 6:33498 | NTIS, PC A02/MF A01. Order Number DE81030028, Distribution Category MN -20d |
| 29798 | 6:33953 | NTIS, PC A04/MF A01. Order Number DE81030027, Distribution Category MN -34 |
| 29817 | 6:33605 | NTIS, PC A02/MF A01. Order Number DE81028330, Distribution Category MN -93 |
| 29823 | 6:33986 | NTIS, PC A02/MF A01. Order Number DE81029324, Distribution Category MN -34D |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 29840 | 6:33987 | NTIS, PC A03/MF A01. Order Number DE81030526, Distribution Category MN -34 |
| 29857 | 6:33387 | NTIS, PC A02/MF A01. Order Number DE81029325, Distribution Category MN -98F |
| 29880 | 6:33464 | NTIS, PC A02/MF A01. Order Number DE81029494, Distribution Category MN -95f |
| 29899 | 6:33318 | NTIS, PC A02/MF A01. Order Number DE81030523, Distribution Category MN -78 |
| 29922 | 6:34036 | NTIS, PC A02/MF A01. Order Number DE81029546, Distribution Category MN -34C |
| 29923 | 6:33686 | NTIS, PC A02/MF A01. Order Number DE81029316, Distribution Category MN -28 |
| 29940 | 6:33687 | NTIS, PC A02/MF A01. Order Number DE81029918, Distribution Category MN -37 |
| 29941 | 6:33499 | NTIS, PC A02/MF A01. Order Number DE81030275, Distribution Category MN -25 |
| 29949 | 6:34018 | NTIS, PC A02/MF A01. Order Number DE81030032, Distribution Category MN -4 |
| 29953 | 6:32806 | NTIS, PC A02/MF A01. Order Number DE81030039, Distribution Category MN -90a |
| 29970 | 6:33158 | NTIS, PC A02/MF A01. Order Number DE81030546, Distribution Category MN -95d |
| 29990 | 6:33669 | NTIS, PC A02/MF A01. Order Number DE81030567, Distribution Category MN -34D |
| 30004 | 6:34037 | NTIS, PC A02/MF A01. Order Number DE81030334, Distribution Category MN -34 |
| 30005 | 6:33678 | NTIS, PC A02/MF A01. Order Number DE81030547, Distribution Category MN -28 |
| 30006 | 6:33679 | NTIS, PC A02/MF A01. Order Number DE81030551, Distribution Category MN -28 |
| 30008 | 6:33680 | NTIS, PC A02/MF A01. Order Number DE81030549, Distribution Category MN -28 |
| 30009 | 6:33681 | NTIS, PC A02/MF A01. Order Number DE81030548, Distribution Category MN -28 |
| 30010 | 6:33682 | NTIS, PC A02/MF A01. Order Number DE81030550, Distribution Category MN -28 |
| 30011 | 6:33683 | NTIS, PC A02/MF A01. Order Number DE81030554, Distribution Category MN -28 |
| 30012 | 6:33630 | NTIS, PC A02/MF A01. Order Number DE81030553, Distribution Category MN -28 |
| 30013 | 6:33684 | NTIS, PC A02/MF A01. Order Number DE81030555, Distribution Category MN -28 |
| 30016 | 6:33500 | NTIS, PC A02/MF A01. Order Number DE81030527, Distribution Category MN -25 |
| 30018 | 6:33501 | NTIS, PC A02/MF A01. Order Number DE81030566, Distribution Category MN -25 |
| 30019 | 6:33502 | NTIS, PC A02/MF A01. Order Number DE81030556, Distribution Category MN -25 |
| 30026 | 6:33965 | NTIS, PC A02/MF A01. Order Number DE81030557, Distribution Category MN -34D |
| 30031 | 6:33688 | NTIS, PC A02/MF A01. Order Number DE81030335, Distribution Category MN -34A |
| 30037 | 6:34043 | NTIS, PC A02/MF A01. Order Number DE81030524, Distribution Category MN -34 |
| 51321 | 6:33446 | NTIS, PC A03/MF A01. Order Number DE81030219, Distribution Category STD -95d |
| 51330 | 6:33398 | NTIS, PC A03/MF A01. Order Number DE81030195, Distribution Category STD -92 |
| 51369 | 6:33631 | NTIS, PC A03/MF A01. Order Number DE81030199, Distribution Category STD -94d |
| 51370 | 6:33377 | NTIS, PC A07/MF A01. Order Number DE81030221, Distribution Category STD -94ca |
| 51378 | 6:33725 | NTIS, PC A04/MF A01. Order Number DE81030225, Distribution Category STD -11 |
| 51381 | 6:33483 | NTIS, PC A02/MF A01. Order Number DE81030829, Distribution Category STD -13 |
| 51389 | 6:33770 | NTIS, PC A03/MF A01. Order Number DE81030095, Distribution Category STD -11 |
| 51394 | 6:33159 | NTIS, PC A02/MF A01. Order Number DE81030220, Distribution Category STD -62 |
| 51396 | 6:33809 | NTIS, PC A02/MF A01. Order Number DE81030148, Distribution Category MN -11 |
| **BNL-NCS-** | | |
| 51346 | 6:34038 | NTIS, PC A06/MF A01. Order Number DE81030205, Distribution Category STD -34C |
| 51364 | 6:34201 | NTIS, PC A04/MF A01. Order Number DE81030204, Distribution Category STD -34D |
| 51388 | 6:34039 | NTIS, PC A04/MF A01. Order Number DE81030196, Distribution Category STD -34C |
| **CALT-** | | |
| 767P8-8 | 6:33588 | NTIS, PC A02/MF A01. Order Number DE81030296, Distribution Category MN -4 |
| **CEND-** | | |
| 389 | 6:33201 | *See* SAND-81-8184 |
| **CONF-7508108-** | | (Preliminary conceptual design conference, Albuquerque, NM, USA, 18-19 Aug 1975) |
| 1 | 6:33141 | NTIS, PC A03/MF A01. Order Number DE81026270, Distribution Category MN -62b |
| **CONF-7803136-** | | (Energy conservation in industry and department of energy facilities conference, Alexandria, VA, USA, 15 Mar 1978) |
| | 6:33444 | NTIS, PC A10/MF A01. Order Number DE81025868, Distribution Category MN -95f |
| **CONF-790122-** | | (Annual meeting of the American Association for the Advancement of Science, Houston, TX, USA, 3-8 Jan 1979) |
| | 6:33811 | Boulder, Colorado; Westview Press, Inc. (1979). |
| **CONF-7905110-** | | (Workshop on the future directions of nuclear physics, Boulder, CO, USA, 29 May-2 Jun 1979) |
| (Summ) | 6:33993 | *See* DOE/ER/10472-1 |
| **CONF-7905197-** | | (Conference on energy in America, Los Angeles, CA, USA, May 1979) |
| | 6:32984 | Los Angeles, CA; University of Southern California Press (1980). |
| **CONF-7906218-** | | (Workshop on world oil and natural gas supplies, Reston, VA, USA, 12-13 Jun 1979) |
| | 6:32961 | *See* EPRI-WS-79-182 |
| | 6:32982 | *See* EPRI-WS-79-182 |
| | 6:32983 | *See* EPRI-WS-79-182 |
| | 6:33406 | *See* EPRI-WS-79-182 |
| | 6:33407 | *See* EPRI-WS-79-182 |
| | 6:33408 | *See* EPRI-WS-79-182 |
| | 6:33409 | *See* EPRI-WS-79-182 |
| | 6:33410 | *See* EPRI-WS-79-182 |
| | 6:33411 | *See* EPRI-WS-79-182 |
| | 6:33412 | *See* EPRI-WS-79-182 |
| | 6:33413 | *See* EPRI-WS-79-182 |
| | 6:33414 | *See* EPRI-WS-79-182 |
| | 6:33415 | *See* EPRI-WS-79-182 |
| | 6:33416 | *See* EPRI-WS-79-182 |
| | 6:33417 | *See* EPRI-WS-79-182 |
| **CONF-791005-** | | (ISA national conference, Chicago, IL, USA, 22-25 Oct 1979) |
| | 6:32854 | Adv. Instrum., 34: 9-15(1979) |

| Report No. | Abstract No. | Availability |
|---|---|---|
| CONF-7910232- | | (1. annual pacific northwest alternative and renewable energy resources conference, Seattle, WA, USA, 15-16 Oct 1979) |
| | 6:33432 | NTIS, PC A03/MF A01. Distribution Category MN -13 |
| CONF-791169- | | (2. international coal utilization exhibition and conference, Houston, TX, USA, 6-8 Nov 1979) |
| | 6:32855 | Coal Technol. (Houston), 3: 223-261(1979) |
| CONF-791263- | | (9. symposium on acoustics imaging: visualization and characteristics, Houston, TX, USA, 3-6 Dec 1979) |
| | 6:33330 | Acoust. Imaging, 9: 39-56(1979) |
| CONF-800159- | | (Photovoltaic materials and device measurements workshop, San Diego, CA, USA, 3-4 Jan 1980) |
| 1 | 6:33130 | *See* MIT-EL-80-008 |
| CONF-800267- | | (Workshop on numerical modeling of thermohydrological flow in fractured rock masses, Berkeley, CA, USA, 19-20 Feb 1980) |
| | 6:33038 | *See* LBL-11566 |
| | 6:33047 | *See* LBL-11566 |
| | 6:33048 | *See* LBL-11566 |
| | 6:33049 | *See* LBL-11566 |
| | 6:33050 | *See* LBL-11566 |
| | 6:33051 | *See* LBL-11566 |
| | 6:33052 | *See* LBL-11566 |
| | 6:33053 | *See* LBL-11566 |
| | 6:33054 | *See* LBL-11566 |
| | 6:33210 | *See* LBL-11566 |
| | 6:33211 | *See* LBL-11566 |
| | 6:33212 | *See* LBL-11566 |
| | 6:33213 | *See* LBL-11566 |
| | 6:33922 | *See* LBL-11566 |
| | 6:33928 | *See* LBL-11566 |
| | 6:33929 | *See* LBL-11566 |
| | 6:33930 | *See* LBL-11566 |
| CONF-800280- | | (Interdisciplinary meeting on hydrogen in metals, Bombay, India, 19-20 Feb 1980) |
| | 6:33503 | NTIS (US Sales Only), PC A14/MF A01. Order Number DE81904020, Distribution Category MN -25 |
| CONF-800433- | | (4. international conference on nuclear methods in environment and energy research, Columbia, MO, USA, 14-17 Apr 1980) |
| | 6:33570 | NTIS, PC A99/MF A01 |
| | 6:33726 | NTIS, PC A99/MF A01 |
| | 6:33727 | NTIS, PC A99/MF A01 |
| | 6:33728 | NTIS, PC A99/MF A01 |
| | 6:33729 | NTIS, PC A99/MF A01 |
| | 6:33730 | NTIS, PC A99/MF A01 |
| | 6:33731 | NTIS, PC A99/MF A01 |
| | 6:33732 | NTIS, PC A99/MF A01 |
| | 6:33733 | NTIS, PC A99/MF A01 |
| | 6:33734 | NTIS, PC A99/MF A01 |
| | 6:33735 | NTIS, PC A99/MF A01 |
| | 6:33736 | NTIS, PC A99/MF A01 |
| | 6:33737 | NTIS, PC A99/MF A01 |
| | 6:33765 | NTIS, PC A99/MF A01 |
| | 6:33772 | NTIS, PC A99/MF A01 |
| | 6:33773 | NTIS, PC A99/MF A01 |
| | 6:33774 | NTIS, PC A99/MF A01 |
| | 6:33775 | NTIS, PC A99/MF A01 |
| | 6:33776 | NTIS, PC A99/MF A01 |
| | 6:33777 | NTIS, PC A99/MF A01 |
| | 6:33778 | NTIS, PC A99/MF A01 |
| | 6:33779 | NTIS, PC A99/MF A01 |
| | 6:33780 | NTIS, PC A99/MF A01 |
| | 6:33781 | NTIS, PC A99/MF A01 |
| | 6:33782 | NTIS, PC A99/MF A01 |
| | 6:33783 | NTIS, PC A99/MF A01 |
| | 6:33784 | NTIS, PC A99/MF A01. Distribution Category STD -11 |
| | 6:33785 | NTIS, PC A99/MF A01 |
| | 6:33786 | NTIS, PC A99/MF A01 |
| | 6:33787 | NTIS, PC A99/MF A01 |
| | 6:33788 | NTIS, PC A99/MF A01 |
| | 6:33789 | NTIS, PC A99/MF A01 |
| | 6:33790 | NTIS, PC A99/MF A01 |
| | 6:33791 | NTIS, PC A99/MF A01 |
| | 6:33792 | NTIS, PC A99/MF A01 |
| | 6:33793 | NTIS, PC A99/MF A01 |
| | 6:33796 | NTIS, PC A99/MF A01 |
| | 6:33797 | NTIS, PC A99/MF A01 |
| | 6:33798 | NTIS, PC A99/MF A01 |
| | 6:33799 | NTIS, PC A99/MF A01 |
| | 6:33800 | NTIS, PC A99/MF A01 |
| | 6:33806 | NTIS, PC A99/MF A01 |
| | 6:33810 | NTIS, PC A99/MF A01 |
| | 6:33812 | NTIS, PC A99/MF A01 |
| | 6:33813 | NTIS, PC A99/MF A01 |
| | 6:33814 | NTIS, PC A99/MF A01 |
| | 6:33815 | NTIS, PC A99/MF A01 |
| | 6:33816 | NTIS, PC A99/MF A01 |
| | 6:33817 | NTIS, PC A99/MF A01 |
| | 6:33818 | NTIS, PC A99/MF A01 |
| | 6:33819 | NTIS, PC A99/MF A01 |
| | 6:33823 | NTIS, PC A99/MF A01 |
| | 6:33824 | NTIS, PC A99/MF A01 |
| | 6:33825 | NTIS, PC A99/MF A01 |
| | 6:33826 | NTIS, PC A99/MF A01 |
| | 6:33838 | NTIS, PC A99/MF A01 |
| | 6:33844 | NTIS, PC A99/MF A01 |
| | 6:33845 | NTIS, PC A99/MF A01 |
| | 6:33865 | NTIS, PC A99/MF A01 |
| | 6:33866 | NTIS, PC A99/MF A01 |
| | 6:33867 | NTIS, PC A99/MF A01 |
| | 6:33868 | NTIS, PC A99/MF A01 |
| | 6:33869 | NTIS, PC A99/MF A01 |
| | 6:33878 | NTIS, PC A99/MF A01 |
| | 6:33879 | NTIS, PC A99/MF A01 |
| | 6:33880 | NTIS, PC A99/MF A01 |
| | 6:33882 | NTIS, PC A99/MF A01 |
| | 6:33883 | NTIS, PC A99/MF A01 |
| | 6:33884 | NTIS, PC A99/MF A01 |
| | 6:33904 | NTIS, PC A99/MF A01 |
| | 6:33905 | NTIS, PC A99/MF A01 |
| | 6:33906 | NTIS, PC A99/MF A01 |
| | 6:33907 | NTIS, PC A99/MF A01 |
| CONF-8004168- | | (Fuel cycle conference, New Orleans, LA, USA, 15-18 Apr 1980) |
| | 6:33019 | Bethesda, MD; Atomic Industrial Forum, Inc. (1980). |
| CONF-800608- | | (Air Pollution Control Association annual meeting, Montreal, Canada, Jun 1980) |
| | 6:32954 | Proc. Air Pollut. Control Assoc., 1: No. 80-6.5, vp(1980) |
| | 6:33275 | Proc. Air Pollut. Control Assoc., 4: No. 80-55.1, vp(1980) |
| CONF-8006186- | | (International conference on analysis of non-metals in metals, Berlin, F.R. Germany, 10-13 Jun 1980) |
| | 6:33543 | Berlin, Germany; Walter de Gruyter and Co. (1981). |
| CONF-800804- | | (ASME century 2 emerging technology conference, San Francisco, CA, USA, 10-22 Aug 1980) |
| 43 | 6:33495 | NTIS, PC A02/MF A01. Order Number DE81028630, Distribution Category MN -25 |
| CONF-800859- | | (International conference on x-ray processes and inner-shell ionization, Stirling, UK, 25-29 Aug 1980) |
| 8 | 6:33954 | NTIS, PC A02/MF A01. Order Number DE81028142, Distribution Category MN -34A |
| CONF-800877- | | (3. international conference on NTD-silicon, Copenhagen, Denmark, 27-29 Aug 1980) |
| 3 | 6:34047 | NTIS, PC A03/MF A01. Order Number DE81028143, Distribution Category MN -34 |
| CONF-8008111- | | (Nuclear engineering conference, San Francisco, CA, USA, 18 Aug 1980) |
| 1 | 6:33303 | NTIS, PC A02/MF A01. Order Number DE81023138, Distribution Category MN -79p |
| CONF-8008123- | | (International Solar Energy Society conference, Brighton, UK, 24-27 Aug 1980) |
| 1 | 6:33169 | *See* IS-M-345 |
| CONF-800980- | | (Applied superconductivity conference, Santa Fe, NM, USA, 29 Sep-2 Oct 1980) |
| | 6:33674 | IEEE Trans. Magn., MAG-17: No. 1, 420-423(Jan 1981) |
| | 6:33675 | IEEE Trans. Magn., MAG-17: No. 1, 709-712(Jan 1981) |
| | 6:33676 | IEEE Trans. Magn., MAG-17: No. 1, 713-716(Jan 1981) |
| CONF-8009166- | | (Conference on biotechnology in Canada: promises and concerns, Aylmer, Quebec, Canada, 16 Sep 1980) |
| | 6:33836 | Ottawa, Ontario; Science Council of Canada (1980). |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| **CONF-8009170-** | (American Public Power Association energy management and communications workshop, Myrtle Beach, SC, USA, 30 Sep-2 Oct 1980) | |
| 3 | 6:33461 | Washington, DC; American Public Power Association (1980). |
| 4 | 6:33431 | Washington, DC; American Public Power Association (1980). |
| **CONF-8009171-** | (Electrochemical Society meeting, Hollywood, FL, USA, 5-10 Sep 1980) | |
| 1 | 6:33441 | *See* DOE/NASA/12726-13 |
| **CONF-8009172-** | (32. symposium on effects of gaseous air pollution in agriculture and horticulture, Nottingham, UK, 1-5 Sep 1980) | |
| 1 | 6:33908 | NTIS, PC A03/MF A01. Order Number DE81029692, Distribution Category MN -48 |
| **CONF-801011-** | (4. ANS topical meeting on the technology of controlled nuclear fusion, King of Prussia, PA, USA, 14-17 Oct 1980) | |
| (Vol.1) | 6:33063 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34051 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34052 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34075 | NTIS, PC A13/MF A01. Order Number DE81027359, Distribution Category STD -20 |
| (Vol.1) | 6:34076 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34077 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34078 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34079 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34080 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34081 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34082 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34083 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34084 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34085 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34086 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34087 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34088 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34089 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34090 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34091 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34092 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34093 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34094 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34095 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34096 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34097 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34098 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34099 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.1) | 6:34100 | NTIS, PC A13/MF A01. Order Number DE81027359 |
| (Vol.2) | 6:33064 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:33066 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:33067 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34101 | NTIS, PC A22/MF A01. Order Number DE81027360, Distribution Category STD -20 |
| (Vol.2) | 6:34102 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34103 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34104 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34105 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34106 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34107 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34108 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34109 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34110 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34111 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34112 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34113 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34114 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34115 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34116 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34117 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34118 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34119 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34120 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34121 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34122 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34123 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34124 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34125 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34126 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34127 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34128 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34129 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34130 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34131 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34132 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34133 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34134 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34135 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34136 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.2) | 6:34137 | NTIS, PC A22/MF A01. Order Number DE81027360 |
| (Vol.3) | 6:34053 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34054 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34055 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34138 | NTIS, PC A99/MF A01. Order Number DE81027361, Distribution Category STD -20 |
| (Vol.3) | 6:34139 | NTIS, PC A99/MF A01. Order Number DE81027361 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| (Vol.3) | 6:34140 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34141 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34142 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34143 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34144 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34145 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34146 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34147 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34148 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34149 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34150 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34151 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34152 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34153 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34154 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34155 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34156 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34157 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34158 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34159 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34160 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34161 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34162 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34163 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34164 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34165 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34166 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34167 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34168 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34169 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| (Vol.3) | 6:34170 | NTIS, PC A99/MF A01. Order Number DE81027361 |
| **CONF-8010214-** | (Coal and ash-handling systems reliability conference and workshop, St Louis, MO, USA, 27-29 Oct 1980) | |
| | 6:32871 | *See* EPRI-WS-79-236 |
| | 6:32872 | *See* EPRI-WS-79-236 |
| | 6:32873 | *See* EPRI-WS-79-236 |
| | 6:32874 | *See* EPRI-WS-79-236 |
| | 6:32875 | *See* EPRI-WS-79-236 |
| | 6:32876 | *See* EPRI-WS-79-236 |
| | 6:32877 | *See* EPRI-WS-79-236 |
| | 6:32894 | *See* EPRI-WS-79-236 |
| | 6:32925 | *See* EPRI-WS-79-236 |
| | 6:32926 | *See* EPRI-WS-79-236 |
| | 6:32927 | *See* EPRI-WS-79-236 |
| | 6:32928 | *See* EPRI-WS-79-236 |
| | 6:32929 | *See* EPRI-WS-79-236 |
| | 6:32930 | *See* EPRI-WS-79-236 |
| | 6:32931 | *See* EPRI-WS-79-236 |
| | 6:32932 | *See* EPRI-WS-79-236 |
| | 6:32933 | *See* EPRI-WS-79-236 |
| | 6:32934 | *See* EPRI-WS-79-236 |
| | 6:32935 | *See* EPRI-WS-79-236 |
| | 6:32936 | *See* EPRI-WS-79-236 |
| | 6:32937 | *See* EPRI-WS-79-236 |
| | 6:32938 | *See* EPRI-WS-79-236 |
| | 6:32939 | *See* EPRI-WS-79-236 |
| | 6:32940 | *See* EPRI-WS-79-236 |
| **CONF-801102-** | (ASME winter annual meeting, Chicago, IL, USA, 16-21 Nov 1980) | |
| | 6:33021 | Am. Soc. Mech. Eng., [Pap.], 11: 19-25(1980) |
| | 6:33043 | Am. Soc. Mech. Eng., [Pap.], 11: 49-57(1980) |
| | 6:33044 | Am. Soc. Mech. Eng., [Pap.], 11: 69-75(1980) |
| **CONF-801103-** | (IEEE nuclear science symposium, Orlando, FL, USA, 5-7 Nov 1980) | |
| 63 | 6:33690 | *See* SLAC-PUB-2642 |
| **CONF-801170-** | (14. Asilomar conference on circuits, systems and computers, Pacific Grove, CA, USA, 17-19 Nov 1980) | |
| 2 | 6:34197 | *See* UCRL-85156-Rev.1 |
| **CONF-801259-** | (Workshop on indoor air quality research needs, Leesburg, VA, USA, 3-5 Dec 1980) | |
| | 6:33738 | NTIS, PC A15/MF A01. Order Number DE81026488, Distribution Category MN -11 |
| | 6:33739 | NTIS, PC A15/MF A01. Order Number DE81026488 |
| | 6:33740 | NTIS, PC A15/MF A01. Order Number DE81026488 |
| | 6:33741 | NTIS, PC A15/MF A01. Order Number DE81026488 |
| | 6:33885 | NTIS, PC A15/MF A01. Order Number DE81026488 |
| **CONF-801266-** | (American Chemical Society meeting, Las Vegas, NV, USA, 1 Dec 1980) | |
| 1 | 6:33762 | *See* UCRL-85035 |
| **CONF-810149-** | (Workshop on computer simulation of organic and biological molecules, Pacific Grove, CA, USA, 5-8 Jan 1981) | |
| | 6:33846 | *See* LBL-12979 |
| **CONF-810153-** | (2. special symposium on natural radiation environment, Bombay, India, 19-23 Jan 1981) | |
| 1 | 6:33766 | *See* LBL-10769 |
| **CONF-810207-** | (SPE economics and evaluation symposium, Dallas, TX, USA, 25-27 Feb 1981) | |
| | 6:32976 | Soc. Pet. Eng. AIME, Pap., 111-120(Feb 1981) |
| **CONF-810214-** | (4. topical conference on radio frequency plasma heating, Austin, TX, USA, 9-10 Feb 1981) | |
| 10 | 6:34057 | *See* DOE/ET/53036-25 |
| **CONF-810260-** | (Special seminar for industry on solar thermal energy, Albuquerque, NM, USA, 3-4 Feb 1981) | |
| 1 | 6:33185 | *See* SAND-81-0373 |
| **CONF-810261-** | (Conference on high temperature, high pressure particulate and alkali control in coal combustion process streams, Morgantown, WV, USA, 3-5 Feb 1981) | |
| 1 | 6:32806 | *See* BNL-29953 |
| **CONF-810309-** | (ASME gas turbine conference, Houston, TX, USA, 9-12 Mar 1981) | |
| 8 | 6:33509 | *See* DOE/NASA/2593-22 |
| **CONF-810319-** | (3. symposium on the transfer and utilization of particulate control technology, Orlando, FL, USA, 9-12 Mar 1981) | |
| 3 | 6:32805 | *See* BNL-22952 |
| **CONF-810376-** | (16. rencontre de moriond: nonperturbative QCD: theory and experiment, Les Arcs, France, 15-27 Mar 1981) | |
| 5 | 6:33985 | *See* BNL-29768 |
| **CONF-810380-** | (Biogas and alcohol fuels seminar, Chicago, IL, USA, 12-13 Mar 1981) | |
| 2 | 6:33084 | Inst. of Gas Technology, 3424 South State St., Chicago, IL 60616 |
| **CONF-810381-** | (Design properties of coal liquids conference, Checotah, OK, USA, 2-4 Mar 1981) | |
| | 6:32807 | NTIS, PC A08/MF A01. Order Number DE81029342, Distribution Category STD -90d |
| **CONF-810391-** | (US National Science Foundation and Japan Society for the Promotion of Science seminar, Honolulu, HI, USA, Mar 1981) | |
| 1 | 6:33504 | NTIS, PC A02/MF A01. Order Number DE81028883, Distribution Category MN -25 |
| **CONF-810393-** | (APCA spring speciality meeting, Renton, WA, USA, 23 Mar 1981) | |
| 1 | 6:33835 | *See* PNL-SA-9419 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **CONF-810394-** | | (American Chemical Society symposium on advances in flue gas desulfurization, Atlanta, GA, USA, 30 Mar-3 Apr 1981) |
| 1 | 6:32878 | *See* LBL-13063 |
| **CONF-810405-** | | (3. annual systems simulation, economic analysis/ solar heating and cooling operational results conference, Reno, NV, USA, 27 Apr-1 May 1981) |
| 17 | 6:33172 | *See* LBL-11387 |
| **CONF-810429-** | | (Conference on optics, Santa Fe, NM, USA, 6-10 Apr 1981) |
| 38 | 6:34176 | *See* LA-UR-81-2468 |
| 39 | 6:34177 | *See* LA-UR-81-2469 |
| **CONF-810442-** | | (Joint workshop on negative ions, Mexico City, Mexico, 1-4 Apr 1981) |
| 4 | 6:34180 | *See* LBL-12995 |
| **CONF-8104106-** | | (3. technical contractors' conference on peat, Bethesda, MD, USA, 29-30 Apr 1981) |
| 1 | 6:32845 | Chicago, IL; Institute of Gas Technology (1981). |
| 2 | 6:32846 | Chicago, IL; Institute of Gas Technology (1981). |
| 3 | 6:32942 | Chicago, IL; Institute of Gas Technology (1981). |
| **CONF-8104107-** | | (12. annual Kentucky industrial coal conference, Lexington, KY, USA, 29-30 Apr 1981) |
| 1 | 6:32879 | Pleasant Hill, CA; Ecolaire Environmental Company (1981). |
| 2 | 6:33273 | Birmingham, Alabama; Zurn Industries (1981). |
| 4 | 6:33647 | Cincinnati, OH; Fosdick and Hilmer, Incorporated (1981). |
| 5 | 6:33482 | Lexington, KY; University of Kentucky (1981). |
| 6 | 6:33663 | Lexington, Kentucky; University of Kentucky (1981). |
| 7 | 6:33274 | Lexington, Kentucky; University of Kentucky (1981). |
| 8 | 6:33401 | Lexington, Kentucky; University of Kentucky (1981). |
| 9 | 6:32959 | Lexington, KY; University of Kentucky (1981). |
| **CONF-810509-** | | (Annual conference of the International Solar Energy Society, Philadelphia, PA, USA, 26-30 May 1981) |
| 40 | 6:33173 | *See* LBL-12048 |
| **CONF-810527-** | | (International conference on plasma science, Sante Fe, NM, USA, 18-20 May 1981) |
| 7 | 6:33438 | *See* DOE/NASA/1062-9 |
| **CONF-810554-** | | (3. symposium on biotechnology in energy production and conservation, Gatlinburg, TN, USA, 12-15 May 1981) |
| 3 | 6:33086 | Inst. of Gas Tech., 3424 South State St., Chicago, IL 60616 |
| **CONF-810584-** | | (NATO advanced study institute on atomistics of France, Corsica, France, 22-31 May 1981) |
| 3 | 6:33531 | *See* PNL-SA-9446 |
| **CONF-8105104-** | | (5. high energy heavy ion study, Berkeley, CA, USA, 18-22 May 1981) |
| 4 | 6:33969 | *See* LBL-12950 |
| **CONF-8105105-** | | (Symposium on electrocatalyis, Minneapolis, MN, USA, 10-15 May 1981) |
| 3 | 6:33605 | *See* BNL-29817 |
| **CONF-8105108-** | | (Annual meeting of the Tennessee Valley Public Power Association, Nashville, TN, USA, 5 May 1981) |
| 1 | 6:33428 | Washington, DC; American Public Power Association (1981). |
| **CONF-8105109-** | | (International conference on physics in collision: High energy ee/ep/pp interactions, Blacksburg, VA, USA, 28-31 May 1981) |
| 1 | 6:33970 | *See* SLAC-PUB-2761 |
| **CONF-8105110-** | | (1981 american industrial hygiene conference, Portland, OR, USA, 24-29 May 1981) |
| 1 | 6:33919 | *See* K/RA-106 |
| **CONF-8105111-** | | (9. north american manufacturing research conference, University Park, PA, USA, 19-22 May 1981) |
| 1 | 6:33499 | *See* BNL-29941 |
| **CONF-8105112-** | | (29. annual scientific meeting of the Radiation Research Society, Minneapolis, MN, USA, 31 May-4 Jun 1981) |
| 1 | 6:33890 | *See* PNL-SA-9315 |
| **CONF-810606-** | | (American Nuclear Society's annual meeting, Miami Beach, FL, USA, 7-12 Jun 1981) |
| 71 | 6:33331 | NTIS, PC A02/MF A01. Order Number DE81026015, Distribution Category MN -80 |
| 72 | 6:33332 | NTIS, PC A02/MF A01. Order Number DE81026016, Distribution Category MN -80 |
| 73 | 6:33341 | NTIS, PC A02/MF A01. Order Number DE81026017, Distribution Category MN -78 |
| 74 | 6:33342 | NTIS, PC A02/MF A01. Order Number DE81026021, Distribution Category MN -78 |
| 76 | 6:33336 | *See* HEDL-SA-2312-FP |
| 77(Rev.1) | 6:33337 | *See* HEDL-SA-2330-Rev.1 |
| 94 | 6:33359 | *See* HEDL-SA-2292-FP |
| 95 | 6:33511 | *See* HEDL-SA-2317 |
| 96 | 6:33671 | *See* LA-UR-81-2571 |
| 97 | 6:33638 | *See* PNL-SA-9635 |
| 98 | 6:33297 | *See* PNL-SA-9641 |
| **CONF-810607-** | | (Symposium on instrumentation and control for fossil energy processes, San Francisco, CA, USA, 8-12 Jun 1981) |
| 12 | 6:32861 | *See* IS-M-330 |
| **CONF-810622-** | | (8. ocean energy conference, Washington, DC, USA, 7-11 Jun 1981) |
| 8 | 6:33443 | Chicago, IL; Institute of Gas Technology (1981). |
| **CONF-810649-** | | (4. international conference on nuclei far from stability, Helsignor, Denmark, 7-13 Jun 1981) |
| 9 | 6:34017 | *See* BNL-29690 |
| **CONF-810651-** | | (1981 topical conference on low-energy X-ray diagnostics, Livermore, CA, USA, 8-10 Jun 1981) |
| 7 | 6:34061 | *See* KMSF-U-1109 |
| **CONF-810659-** | | (3. IEEE international pulsed power conference, Albuquerque, NM, USA, 1-3 Jun 1981) |
| 28 | 6:33658 | *See* SAND-81-0754C |
| **CONF-810674-** | | (1981 international conference on residential solid fuels, Portland, OR, USA, 1-5 Jun 1981) |
| 4 | 6:33445 | *See* BNL-29763 |
| 5 | 6:33761 | *See* PNL-SA-9606 |
| **CONF-810675-** | | (15. rare earth research conference, Rolla, MO, USA, 15-18 Jun 1981) |
| 4 | 6:33591 | *See* PNL-SA-9377 |
| **CONF-810680-** | | (Symposium on physics problems of fusion reactors, Trieste, Italy, 2-9 Jun 1981) |
| 3 | 6:34065 | *See* ORNL/TM-7857 |
| **CONF-810684-** | | (APS conference on shock waves in condensed matter, Menlo Park, CA, USA, 23-25 Jun 1981) |
| 48 | 6:33716 | *See* UCRL-86563 |
| 50 | 6:33715 | *See* UCRL-86372 |
| **CONF-8106127-** | | (3. Cleveland symposium on macromolecules: recombinant DNA, Cleveland, OH, USA, 22-26 Jun 1981) |
| 1 | 6:33858 | *See* BNL-29733 |
| **CONF-8106137-** | | (WATERPOWER 1981 conference, Washington, DC, USA, 22-24 Jun 1981) |
| 5 | 6:33089 | *See* EGG-M-02781 |
| **CONF-8106144-** | | (Health Physics Society annual meeting, Louisville, KY, USA, 21-26 Jun 1981) |
| 4 | 6:33362 | *See* PNL-SA-9316 |
| 5 | 6:33057 | *See* PNL-SA-9262 |
| 6 | 6:34042 | *See* PNL-SA-9317 |
| **CONF-8106145-** | | (1981 workshop on free electron lasers, Sun Valley, ID, USA, 22-25 Jun 1981) |
| 2 | 6:33648 | *See* LA-UR-81-2568 |
| **CONF-8106146-** | | (Workshop on nonperturbative studies in quantum chromodynamics, Providence, RI, USA, 19-20 Jun 1981) |
| 1 | 6:33986 | *See* BNL-29823 |
| **CONF-8106147-** | | (Atmospheric chemical society conference on atmospheric sciences, Albany, NY, USA, 29 Jun 1981) |
| 1 | 6:33590 | *See* LBL-12986 |
| **CONF-8106148-** | | (North Atlantic Treaty Organization-advanced summer institute summer school on QED of strong fields, Lahnstein, F.R. Germany, 14-26 Jul 1981) |
| 1 | 6:33974 | *See* LBL-12972 |
| **CONF-8106150-** | | (CESRII workshop, Ithaca, NY, USA, 18 Jun 1981) |
| 1 | 6:33686 | *See* BNL-29923 |
| **CONF-8106153-** | | (Modern trends in neutron activation conference, Toronto, Canada, 5-9 Jun 1981) |
| 1 | 6:33581 | *See* PNL-SA-9143 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **CONF-8106154-** | | (1981 March of Dimes Birth Defects conference, San Diego, CA, USA, 15-18 Jun 1981) |
| 1 | 6:33913 | *See* PNL-SA-9435 |
| **CONF-8106155-** | | (Conference on science and the information onslaught, Los Alamos, NM, USA, 1-5 Jun 1981) |
| 1 | 6:34198 | *See* UCRL-86581 |
| **CONF-8106156-** | | (International conference on neutrino physics and astrophysics, Maui, HI, USA, 30 Jun-9 Jul 1981) |
| 1 | 6:33934 | *See* LA-UR-81-2505 |
| 2 | 6:33983 | *See* LA-UR-81-2635 |
| **CONF-810714-** | | (Conference on ground control in mining, Morgantown, WV, USA, 27-29 Jul 1981) |
| 3 | 6:32903 | NTIS, PC A02/MF A01. Order Number DE81028754, Distribution Category MN -88 |
| **CONF-810722-** | | (International symposium on migration in the terrestrial environment of long-lived radionuclides from the nuclear fuel cycle, Knoxville, TN, USA, 27-31 Jul 1981) |
| 8 | 6:33795 | *See* BNL-29762 |
| 12 | 6:33767 | *See* PNL-SA-9140 |
| **CONF-810730-** | | (1981 national conference on environmental engineering, Atlanta, GA, USA, 8-10 Jul 1981) |
| 3 | 6:33085 | Inst. of Gas Tech., 3424 South State St., Chicago, IL 60616 |
| **CONF-810731-** | | (14. annual technology meeting of international metallographic society, San Francisco, CA, USA, 21-22 Jul 1981) |
| 3 | 6:33309 | *See* HEDL-SA-2333-FP |
| **CONF-810738-** | | (4. SALE program participants meeting, Argonne, IL, USA, Jul 1981) |
| 3 | 6:33059 | *See* IS-M-337 |
| **CONF-810742-** | | (4. U.S. national conference on wind engineering research, Seattle, WA, USA, 26-29 Jul 1981) |
| 2 | 6:33632 | NTIS, PC A02/MF A01. Order Number DE81029478, Distribution Category MN -38 |
| 3 | 6:33234 | *See* PNL-SA-9149 |
| **CONF-810746-** | | (International symposium on the fracture mechanics of ceramics, University Park, PA, USA, 15-17 Jul 1981) |
| 2 | 6:33550 | *See* SAND-81-0064C |
| **CONF-810747-** | | (9. international conference on high energy physics and nuclear structure, Versailles, France, 6-10 Jul 1981) |
| 4 | 6:33995 | *See* LA-UR-81-2410 |
| **CONF-810748-** | | (Commercial photovoltaics measurements workshop, Vail, CO, USA, 27-29 Jul 1981) |
| 1 | 6:33096 | *See* SERI/TP-642-1343 |
| 2 | 6:33116 | *See* PNL-SA-9751 |
| **CONF-810750-** | | (2. national conference on synchrotron radiation instrumentation, Ithaca, NY, USA, 15-17 Jul 1981) |
| 5 | 6:33687 | *See* BNL-29940 |
| **CONF-810754-** | | (12. IPEAC international conference on the physics of electronics and atomic collisions, Gatlinburg, TN, USA, 15-22 Jul 1981) |
| 2 | 6:34184 | *See* SAND-81-1864C |
| **CONF-810755-** | | (Conference on statistical and epidemiological methods in ionizing radiation, Berkeley Springs, WV, USA, 6-10 Jul 1981) |
| 1 | 6:33891 | *See* PNL-SA-9632 |
| **CONF-810756-** | | (International school of physics position in solids conference, Lake Como, Italy, 14-24 Jul 1981) |
| 1 | 6:33953 | *See* BNL-29798 |
| **CONF-810757-** | | (56. annual conference of the western economic association, San Francisco, CA, USA, 3 Jul 1981) |
| 2 | 6:33460 | *See* PNL-SA-9049 |
| **CONF-810758-** | | (Conference on physics of intercalation compounds, Trieste, Italy, 6-10 Jul 1981) |
| 1 | 6:33557 | *See* DOE/ER/01198-1354 |
| **CONF-810759-** | | (Physics opportunities at ISABELLE summer workshop, Upton, NY, USA, 20-31 Jul 1981) |
| 1 | 6:33669 | *See* BNL-29990 |
| **CONF-810760-** | | (International conference on high energy physics, Lisbon, Portugal, 9-15 Jul 1981) |
| 1 | 6:33965 | *See* BNL-30026 |
| **CONF-810761-** | | (AGU chapman conference on spatial variability in hydrology, Fort Collins, CO, USA, 21 Jul 1981) |
| 1 | 6:33923 | *See* PNL-SA-9478 |
| **CONF-810762-** | | (19. international school of subnuclear physics, Erice, Italy, 31 Jul-11 Aug 1981) |
| 1 | 6:33987 | *See* BNL-29840 |
| **CONF-810801-** | | (6. international conference on structural mechanics in reactor technology, Paris, France, 17-21 Aug 1981) |
| 57 | 6:33556 | NTIS, PC A02/MF A01. Order Number DE81028071, Distribution Category MN -80 |
| **CONF-810803-** | | (Topical meeting on reactor safety aspects of fuel behavior, Sun Valley, ID, USA, 2-6 Aug 1981) |
| 9 | 6:33358 | *See* HEDL-SA-2288-S |
| 10 | 6:33357 | *See* HEDL-SA-2284-FP |
| 11 | 6:33356 | *See* HEDL-SA-2272 |
| 12 | 6:33355 | *See* HEDL-SA-2264-FP |
| 13 | 6:33354 | *See* HEDL-SA-2263-FP |
| **CONF-810804-** | | (20. national heat transfer conference, Milwaukee, WI, USA, 2-5 Aug 1981) |
| 15 | 6:33635 | *See* HEDL-SA-2201-FP |
| 16 | 6:32977 | Chicago, IL; Institute of Gas Technology (1981). |
| 17 | 6:33963 | *See* PNL-SA-9712 |
| **CONF-810806-** | | (Conference on small break loss of coolant accident analysis in LWR's, Monterey, CA, USA, 25-27 Aug 1981) |
| 8 | 6:33343 | NTIS, PC A02/MF A01. Order Number DE81028072, Distribution Category MN -78 |
| **CONF-810809-** | | (16. international conference on low temperature physics, Los Angeles, CA, USA, 19-25 Aug 1981) |
| 17 | 6:33957 | *See* LA-UR-81-2473 |
| **CONF-810810-** | | (SPIE international symposium, San Diego, CA, USA, 24-28 Aug 1981) |
| 23 | 6:33697 | *See* EGG-1183-1777 |
| 24 | 6:34179 | *See* LA-UR-81-2524 |
| 25 | 6:34178 | *See* LA-UR-81-2523 |
| 26 | 6:34186 | *See* UCRL-85645 |
| **CONF-810812-** | | (IECEC conference, Atlanta, GA, USA, 9-14 Aug 1981) |
| 29 | 6:33559 | *See* IS-M-329 |
| 36 | 6:33311 | *See* HEDL-SA-2386 |
| 37 | 6:33310 | *See* HEDL-SA-2371 |
| **CONF-810814-** | | (91. national meeting of the American Institute of Chemical Engineers, Detroit, MI, USA, 16-19 Aug 1981) |
| 8 | 6:32941 | Chicago, IL; Institute of Gas Technology (1981). |
| 9 | 6:33028 | *See* DP-MS-81-18 |
| **CONF-810827-** | | (8. AIRAPT conference and 19. EHPRG conference, Uppsala, Sweden, 17-22 Aug 1981) |
| 5 | 6:33533 | *See* SAND-81-1358C |
| 10 | 6:33521 | *See* LA-UR-81-2426 |
| **CONF-810828-** | | (Conference on high pressure physics, Bad Honnef, F.R. Germany, Aug 1981) |
| 6 | 6:34046 | *See* SAND-81-1151C |
| **CONF-810831-** | | (Fusion reactor materials meeting, Seattle, WA, USA, 9-12 Aug 1981) |
| 11 | 6:33505 | NTIS, PC A02/MF A01. Order Number DE81028612, Distribution Category MN -20c |
| 39 | 6:34172 | *See* GA-A-16384 |
| 42 | 6:34174 | *See* HEDL-SA-2476-FP |
| 44 | 6:33515 | *See* HEDL-SA-2357 |
| 45 | 6:33512 | *See* HEDL-SA-2338-FP |
| 46 | 6:34173 | *See* HEDL-SA-2340FP |
| 47 | 6:33514 | *See* HEDL-SA-2342-FP |
| 48 | 6:33513 | *See* HEDL-SA-2341 |
| 49 | 6:33516 | *See* HEDL-SA-2359 |
| 50 | 6:33498 | *See* BNL-29779 |
| 52 | 6:34056 | NTIS, PC A02/MF A01. Order Number DE81029669, Distribution Category MN -20a |
| 53 | 6:33530 | *See* PNL-SA-9266 |
| 54 | 6:33532 | *See* PNL-SA-9728 |
| 55 | 6:33522 | *See* LA-UR-81-2437 |
| **CONF-810832-** | | (DOE passive and hybrid solar energy program update, Washington, DC, USA, 9-12 Aug 1981) |
| 6 | 6:33168 | *See* IS-M-334 |
| **CONF-810833-** | | (Mechanical, magnetic, and underground energy storage 1981 annual contractors' review meeting, Washington, DC, USA, 24-26 Aug 1981) |
| 9 | 6:33370 | *See* PNL-SA-9782 |
| **CONF-810835-** | | (1931 cryogenic engineering conference, San Diego, CA, USA, 10-14 Aug 1981) |
| 5 | 6:33640 | *See* UCRL-85564 |
| 12 | 6:33633 | NTIS, PC A02/MF A01. Order Number DE81026548, Distribution Category MN -20b |
| 18 | 6:33637 | *See* LBL-12783 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 19 | 6:33683 | *See* BNL-30011 |
| 20 | 6:33684 | *See* BNL-30013 |
| 21 | 6:33679 | *See* BNL-30006 |
| 22 | 6:33681 | *See* BNL-30009 |
| 23 | 6:33680 | *See* BNL-30008 |
| 24 | 6:33682 | *See* BNL-30010 |
| 25 | 6:33678 | *See* BNL-30005 |
| 26 | 6:33500 | *See* BNL-30016 |
| 27 | 6:33502 | *See* BNL-30019 |
| 28 | 6:33501 | *See* BNL-30018 |
| 29 | 6:33630 | *See* BNL-30012 |
| **CONF-810838-** | (Conference on oil shale, the environmental challenges II, Vail, CO, USA, 10-13 Aug 1981) | |
| 2 | 6:32997 | *See* PNL-SA-9792 |
| **CONF-810839-** | (AF/DARPA review of progress in quantitative NDE, Boulder, CO, USA, 2-7 Aug 1981) | |
| 1 | 6:33655 | *See* RFP-3208 |
| **CONF-810840-** | (Symposium on neutron scattering, Argonne, IL, USA, 12-14 Aug 1981) | |
| 2 | 6:34036 | *See* BNL-29922 |
| 3 | 6:34018 | *See* BNL-29949 |
| 4 | 6:33578 | *See* LA-UR-81-2531 |
| **CONF-810841-** | (12. NATO/CCMS international technical meeting on air pollution modeling and its applications, Menlo Park, CA, USA, 25-28 Aug 1981) | |
| 2 | 6:33760 | *See* PNL-SA-8432 |
| **CONF-810845-** | (4. workshop on gases in strong rotation, Oxford, UK, 24-27 Aug 1981) | |
| 2 | 6:33016 | *See* LA-UR-81-1821 |
| 3 | 6:33619 | *See* LA-UR-81-2530 |
| **CONF-810851-** | (4. international conference on rapidly quenched metals, Sendai, Japan, 24-28 Aug 1981) | |
| 2 | 6:33545 | NTIS, PC A02/MF A01. Order Number DE81028141, Distribution Category MN -34 |
| 3 | 6:33523 | *See* LA-UR-81-2444 |
| **CONF-810856-** | (International conference on the science of hard materials, Moran, WY, USA, 23-28 Aug 1981) | |
| 1 | 6:33546 | NTIS, PC A03/MF A01. Order Number DE81028069, Distribution Category MN -25 |
| **CONF-810860-** | (ASM international conference on solid-solid phase transformations, Pittsburgh, PA, USA, 10-14 Aug 1981) | |
| 1 | 6:33518 | *See* IS-M-338 |
| 2 | 6:33534 | *See* Y/DV-134 |
| 3 | 6:33525 | *See* LA-UR-81-2456 |
| 4 | 6:33524 | *See* LA-UR-81-2455 |
| **CONF-810861-** | (OECD Nuclear Energy Agency workshop on near-field phenomena in geologic respositories for radioactive waste, Seattle, WA, USA, 31 Aug-3 Sep 1981) | |
| 2 | 6:33037 | *See* LA-UR-81-2584 |
| **CONF-810863-** | (5. international meeting on ferroelectricity, University Park, PA, USA, 17-21 Aug 1981) | |
| 1 | 6:33561 | *See* SAND-81-1834C |
| 2 | 6:34037 | *See* BNL-30004 |
| **CONF-810864-** | (International conference on low-dimensional conductors, Boulder, CO, USA, 10-14 Aug 1981) | |
| 1 | 6:33120 | *See* SERI/TP-233-1388 |
| **CONF-810865-** | (Solar world forum, Brighton, UK, 23-28 Aug 1981) | |
| 1 | 6:33115 | *See* PNL-SA-9246 |
| 2 | 6:33171 | *See* LA-UR-81-2518 |
| 3 | 6:33170 | *See* LA-UR-81-2500 |
| **CONF-810866-** | (NATO advanced study institute on excitations in disordered systems, E Lansing, MI, USA, 23 Aug-4 Sep 1981) | |
| 1(Draft) | 6:33506 | NTIS, PC A03/MF A01. Order Number DE81029659, Distribution Category MN -25 |
| **CONF-810868-** | (6. international conference on fast ion beam spectroscopy, Quebec, Canada, 17-20 Aug 1981) | |
| 1 | 6:33955 | NTIS, PC A02/MF A01. Order Number DE81026542, Distribution Category MN -34 |
| **CONF-810870-** | (Plasma astrophysics course and workshop, Varenna, Italy, 27 Aug-7 Sep 1981) | |
| 1 | 6:33935 | *See* LA-UR-81-2575 |
| **CONF-810871-** | (Workshop on gamma ray transients and related astrophysical phenomena, La Jolla, CA, USA, 5-8 Aug 1981) | |
| 1 | 6:33936 | *See* LA-UR-81-2591 |
| **CONF-810872-** | (International conference on phonon physics, Bloomington, IN, USA, 30 Aug-3 Sep 1981) | |
| 1 | 6:34043 | *See* BNL-30037 |
| **CONF-810905-** | (ANS/ENS topical meeting on probabilistic risk assessment, Post Chester, NY, USA, 20-24 Sep 1981) | |
| 5 | 6:33317 | *See* LA-UR-81-2595 |
| **CONF-810906-** | (10. European conference on controlled fusion and plasma physics, Moscow, USSR, 14-19 Sep 1981) | |
| 6 | 6:34072 | *See* UCRL-86162 |
| 7 | 6:34073 | *See* UCRL-86163 |
| 8 | 6:34062 | *See* LA-UR-81-2572 |
| **CONF-810909-** | (Institute of Gas Research conference, Los Angeles, CA, USA, 28 Sep-1 Oct 1981) | |
| 4 | 6:33758 | *See* LBL-12887 |
| **CONF-810911-** | (Oceans 1981 conference, Boston, MA, USA, 16-18 Sep 1981) | |
| 2 | 6:33154 | *See* LBL-12977 |
| 3 | 6:33157 | *See* SERI/TP-634-1282 |
| **CONF-810912-** | (Annual DOE active solar heating and cooling contractor's review meeting, Washington, DC, USA, Sep 1981) | |
| 11 | 6:33202 | *See* SERI/TP-620-1344 |
| 13(Rev.) | 6:33174 | *See* LBL-13054-Rev. |
| (Prelim.) | 6:33160 | NTIS, PC A13/MF A01. Order Number DE81028052, Distribution Category MN -59 |
| **CONF-810914-** | (International conference on coal science, Dusseldorf, F.R. Germany, 7-9 Sep 1981) | |
| 4 | 6:33606 | NTIS, PC A02/MF A01. Order Number DE81029685, Distribution Category MN -90a |
| 5 | 6:32857 | NTIS, PC A02/MF A01. Order Number DE81029683, Distribution Category MN -90a |
| 6 | 6:32808 | NTIS, PC A02/MF A01. Order Number DE81029684, Distribution Category MN -90a |
| **CONF-810925-** | (6. national passive conference, Portland, OR, USA, 8-12 Sep 1981) | |
| 21 | 6:33158 | *See* BNL-29970 |
| **CONF-810931-** | (1. symposium on gages and piezoresistive materials, Archon, France, 29 Sep-1 Oct 1981) | |
| 2(Rev.1) | 6:33702 | *See* UCRL-85763-Rev.1 |
| 3 | 6:33710 | *See* LA-UR-81-2482 |
| **CONF-810938-** | (4. international EVDG conference and demonstration, London, UK, 15-16 Sep 1981) | |
| 1 | 6:33492 | *See* UCRL-86560 |
| **CONF-810939-** | (International congress on instrumentation in aerospace simulation facilities, Dayton, OH, USA, 30 Sep-2 Oct 1981) | |
| 1 | 6:33964 | *See* SAND-81-1135C |
| **CONF-810941-** | (ANS technical base for nuclear fuel cycle policy, Newport, RI, USA, 20-23 Sep 1981) | |
| 1 | 6:33302 | NTIS, PC A02/MF A01. Order Number DE81025742, Distribution Category MN -79 |
| 3 | 6:33318 | *See* BNL-29899 |
| **CONF-810942-** | (International Energy Agency Annex I workshop on thermochemical hydrogen, Julich, F.R. Germany, 23-25 Sep 1981) | |
| 1 | 6:33065 | *See* UCRL-86600 |
| 2 | 6:33076 | *See* UCRL-86622 |
| 3 | 6:33077 | *See* UCRL-86623 |
| 5 | 6:33073 | *See* LA-UR-81-2477 |
| 6 | 6:33074 | *See* LA-UR-81-2628 |
| **CONF-810943-** | (Conference on chemistry of materials at high temperatures, Harwell, Oxfordshire, UK, 7-10 Sep 1981) | |
| 1 | 6:33055 | *See* UCRL-85553 |
| 2 | 6:33507 | NTIS, PC A03/MF A01. Order Number DE81029675, Distribution Category MN -90h |
| 4 | 6:33308 | *See* GEFR-SP-236 |
| **CONF-810944-** | (9. international conference on cyclotrons and their applications, Caen, France, 7-10 Sep 1981) | |
| 1 | 6:33670 | NTIS, PC A02/MF A01. Order Number DE81029653, Distribution Category MN -28 |
| **CONF-810945-** | (Conference on the economics of mined-land reclamation, Chicago, IL, USA, 1-2 Sep 1981) | |
| | 6:32880 | *See* ANL/LRP-TM-20 |
| | 6:32881 | *See* ANL/LRP-TM-20 |
| | 6:32882 | *See* ANL/LRP-TM-20 |
| | 6:32883 | *See* ANL/LRP-TM-20 |
| | 6:32884 | *See* ANL/LRP-TM-20 |
| | 6:32885 | *See* ANL/LRP-TM-20 |
| | 6:32886 | *See* ANL/LRP-TM-20 |
| | 6:32887 | *See* ANL/LRP-TM-20 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| | 6:32888 | *See* ANL/LRP-TM-20 |
| | 6:32889 | *See* ANL/LRP-TM-20 |
| | 6:32890 | *See* ANL/LRP-TM-20 |
| | 6:32891 | *See* ANL/LRP-TM-20 |
| | 6:32892 | *See* ANL/LRP-TM-20 |
| | 6:32955 | *See* ANL/LRP-TM-20 |
| | 6:32956 | *See* ANL/LRP-TM-20 |
| | 6:32957 | *See* ANL/LRP-TM-20 |
| | 6:32958 | *See* ANL/LRP-TM-20 |
| **CONF-810946-** | (Conference on advancement in heat exchangers, Dubrovnik, Yugoslavia, 7-12 Sep 1981) | |
| 1 | 6:33253 | NTIS, PC A02/MF A01. Order Number DE81029686, Distribution Category MN -38 |
| **CONF-810947-** | (European workshop on the behavior of magnetically-confined plasmas, Wildhaus, Switzerland, 9-11 Sep 1981) | |
| 1 | 6:34060 | *See* GA-A-16441 |
| 2 | 6:34059 | *See* GA-A-16418 |
| 3 | 6:34058 | *See* GA-A-16400 |
| **CONF-810948-** | (Actinides-1981 conference, Pacific Grove, CA, USA, 10-15 Sep 1981) | |
| (Absts) | 6:33621 | *See* LBL-12441 |
| **CONF-810949-** | (5. uranium seminar, Albuquerque, NM, USA, Sep 1981) | |
| 1 | 6:33015 | *See* LA-UR-81-2451 |
| **CONF-810950-** | (Conference of the Advisory Group for Aerospace Research and Development-North Atlantic Treaty Organization, Munich, F.R. Germany, 9-10 Sep 1981) | |
| 1 | 6:34202 | *See* UCRL-85749 |
| **CONF-810952-** | (1981 joint electrical engineering seminar for divisions of Union Carbide, Nashville, TN, USA, 17-18 Sep 1981) | |
| 1 | 6:33643 | *See* Y/IA-152 |
| **CONF-811002-** | (7. AIAA aerodynamic decelerator and balloon technology conference, San Diego, CA, USA, 21-23 Oct 1981) | |
| 1 | 6:33639 | *See* SAND-81-0208C |
| **CONF-811006-** | (International conference on energy use management--III, West Berlin, F.R. Germany, 26-30 Oct 1981) | |
| 4 | 6:33387 | *See* BNL-29857 |
| **CONF-811007-** | (2. world congress of chemical engineering, Montreal, Canada, 4-9 Oct 1981) | |
| 3 | 6:33203 | *See* SERI/TP-631-1163 |
| **CONF-811010-** | (6. electric vehicle council symposium, Baltimore, MD, USA, 21-23 Oct 1981) | |
| 2 | 6:33491 | *See* SAND-81-1814C |
| **CONF-811014-** | (11. North American Thermal Analysis Society conference, New Orleans, LA, USA, 19-21 Oct 1981) | |
| 3 | 6:33709 | *See* LA-UR-81-1835 |
| **CONF-811015-** | (Geothermal Resources Council annual meeting, Houston, TX, USA, 25-29 Oct 1981) | |
| 7 | 6:33218 | *See* LA-UR-81-1765 |
| 8 | 6:33219 | *See* LA-UR-81-1807 |
| 13 | 6:33222 | *See* UCRL-86148 |
| **CONF-811016-** | (Conference on electrical insulation and dielectric phenomena, Whitehaven, PA, USA, 25-28 Oct 1981) | |
| 1 | 6:33552 | *See* SAND-81-0786C |
| 2 | 6:33276 | NTIS, PC A02/MF A01. Order Number DE81029140, Distribution Category MN -97a |
| **CONF-811020-** | (National electronics conference, Chicago, IL, USA, 26-28 Oct 1981) | |
| 1 | 6:34203 | *See* UCRL-86143 |
| **CONF-811024-** | (National engineering consortium, Chicago, IL, USA, 26-28 Oct 1981) | |
| 1 | 6:34195 | *See* SAND-81-1007C |
| **CONF-811026-** | (5. geopressured-geothermal energy conference, Baton Rouge, LA, USA, 13-15 Oct 1981) | |
| 2 | 6:33223 | *See* UCRL-86515 |
| 5 | 6:32990 | NTIS, PC A02/MF A01. Order Number DE81029772, Distribution Category MN -92a |
| 6 | 6:32991 | NTIS, PC A02/MF A01. Order Number DE81029773, Distribution Category MN -92a |
| 8 | 6:33214 | NTIS, PC A02/MF A01. Order Number DE81029798, Distribution Category MN -66a |
| **CONF-811030-** | (4. world engineering congress, Atlanta, GA, USA, 12-15 Oct 1981) | |
| 1 | 6:33464 | *See* BNL-29880 |
| **CONF-811033-** | (6. international symposium on ballistics, Orlando, FL, USA, 22-24 Oct 1981) | |
| 1 | 6:33641 | *See* UCRL-85877 |
| **CONF-811034-** | (2. national technical conference on earth sheltered buildings, Tulsa, OK, USA, 16-17 Oct 1981) | |
| 1 | 6:33161 | NTIS, PC A02/MF A01. Order Number DE81027979, Distribution Category MN -59c |
| **CONF-811036-** | (3. conference on acoustic emission/microseismic activity in geologic structures and materials, University Park, PA, USA, 5-7 Oct 1981) | |
| 1 | 6:32987 | *See* LA-UR-81-2622 |
| **CONF-811037-** | (TMS/AIME fall meeting on advanced techniques for the characterization of hydrogen in metals, Louisville, KY, USA, 11-15 Oct 1981) | |
| 1 | 6:33654 | *See* DP-MS-81-12 |
| **COO-** | | |
| 1367-121 | 6:33504 | *See* CONF-810391-1 |
| 3214-20 | 6:33859 | *See* DOE/EV/03214-T3 |
| 4040-5 | 6:33346 | *See* DOE/ET/37227-T4 |
| 4040-6 | 6:33345 | *See* DOE/ET/37227-T2 |
| 4040-7 | 6:33344 | *See* DOE/ET/37227-T1 |
| 4195-5 | 6:33967 | *See* DOE/ER/04195-5 |
| 4703-26 | 6:33372 | NTIS, PC A05/MF A01. Distribution Category STD -94a |
| **CSIRO-** | | |
| 2 | 6:32904 | NTIS (US Sales Only), PC A03/MF A01. Order Number DE81904078, Distribution Category MN -88 |
| 3 | 6:32905 | NTIS (US Sales Only), PC A03/MF A01. Order Number DE81904077, Distribution Category MN -88 |
| 5 | 6:32922 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1978). |
| 7 | 6:32858 | NTIS (US Sales Only), PC A02/MF A01. Order Number DE81904106, Distribution Category MN -88 |
| 10 | 6:32901 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1979). |
| 11 | 6:32863 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). |
| 12 | 6:32919 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). |
| 14 | 6:32921 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1979). |
| 15 | 6:32918 | Mount Waverely, Australia; Commonwealth Scientific and Industrial Research Organization (1980). |
| 17 | 6:32913 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). |
| 19 | 6:32914 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). |
| 20 | 6:32915 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). |
| 22 | 6:32916 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). |
| 23 | 6:32912 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1981). |
| 27 | 6:32917 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| 28 | 6:32920 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). |
| 31 | 6:32900 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1981). |
| **DOE/BETC/PPS-** | | |
| 81/ 3 | 6:32988 | NTIS, PC A04/MF A01. Order Number DE81030845, Distribution Category STD -92 |
| 81/ 4 | 6:32985 | NTIS, PC A03/MF A01. Order Number DE81030833, Distribution Category STD -92 |
| **DOE/CE-** | | |
| 0016 | 6:33394 | NTIS, PC A03/MF A01. Order Number DE81025862, Distribution Category STD -95 |
| **DOE/CS/20074-** | | |
| 1 | 6:33473 | NTIS, PC A19/MF A01. Order Number DE81029689, Distribution Category STD -95f |
| **DOE/CS/20167-** | | |
| 6 | 6:33474 | NTIS, PC A05/MF A01. Order Number DE81029908, Distribution Category STD -95e |
| **DOE/CS/20205-** | | |
| T17 | 6:33447 | NTIS, PC A02/MF A01. Order Number DE81021861, Distribution Category MN -95d |
| **DOE/CS/20243-** | | |
| 1 | 6:33475 | NTIS, PC A07/MF A01. Order Number DE81030098, Distribution Category STD -95e |
| **DOE/CS/20321-** | | |
| 1 | 6:33476 | NTIS, PC A07/MF A01. Order Number DE81030163, Distribution Category MN -95d |
| **DOE/CS/30174-** | | |
| T2Vol.1 | 6:33192 | NTIS, PC A05/MF A01. Order Number DE81030820, Distribution Category STD -59c |
| **DOE/CS/30209-** | | |
| T4 | 6:33162 | NTIS, PC A04/MF A01. Order Number DE81029308, Distribution Category MN -59 |
| **DOE/CS/32197-** | | |
| T1 | 6:33163 | NTIS, PC A08/MF A01. Order Number DE81023642, Distribution Category STD -59b |
| **DOE/CS/35224-** | | |
| T1 | 6:33448 | NTIS, PC A05/MF A01. Order Number DE81028998, Distribution Category MN -95d |
| **DOE/CS/40087-** | | |
| T1 | 6:33465 | NTIS, PC A09/MF A01. Order Number DE81028819, Distribution Category STD -95f |
| **DOE/CS/51175-** | | |
| T18 | 6:33462 | NTIS, PC A05/MF A01. Order Number DE81029835, Distribution Category MN -96 |
| **DOE/CS/54224-** | | |
| T1-Vol.1 | 6:33484 | NTIS, PC A04/MF A01. Order Number DE81025739, Distribution Category MN -96 |
| T1-Vol.2 | 6:33485 | NTIS, PC A16/MF A01. Order Number DE81025939, Distribution Category MN -96 |
| **DOE/DP/00539-** | | |
| 043 | 6:33802 | *See* EPA/600-4-81-047 |
| **DOE/DP/00789-** | | |
| T15 | 6:33240 | NTIS, PC A02/MF A01. Order Number DE81030129, Distribution Category MN -60 |
| **DOE/EIA-** | | |
| 0272 | 6:33449 | NTIS, PC A04/MF A01. Order Number DE81029910, Distribution Category MN -13 |
| **DOE/EIA/10612-** | | |
| T26 | 6:33390 | NTIS, PC A08/MF A01. Order Number DE81029287, Distribution Category MN -97b |
| T26-Apps.B-C | 6:33419 | NTIS, PC A08/MF A01. Order Number DE81029288, Distribution Category MN -97b |
| **DOE/EP-** | | |
| 0006 | 6:33384 | NTIS, PC A14/MF A01. Order Number DE81028683, Distribution Category STD -32 |
| 0026 | 6:33839 | NTIS, PC A22/MF A01. Order Number DE81029809, Distribution Category STD -11 |
| 0028 | 6:33840 | NTIS, PC A15/MF A01. Order Number DE81029993, Distribution Category STD -11 |
| **DOE/EP/10012-** | | |
| 1 | 6:33771 | NTIS, PC A06/MF A01 |
| 1 | 6:33808 | NTIS, PC A06/MF A01 |
| 1 | 6:33832 | NTIS, PC A06/MF A01 |
| 1 | 6:33833 | NTIS, PC A06/MF A01 |
| 1 | 6:33834 | NTIS, PC A06/MF A01 |
| 1 | 6:33841 | NTIS, PC A06/MF A01 |
| 1 | 6:33842 | NTIS, PC A06/MF A01 |
| 1 | 6:33843 | NTIS, PC A06/MF A01 |
| 1 | 6:33916 | NTIS, PC A06/MF A01 |
| **DOE/ER-** | | |
| 0104 | 6:33685 | NTIS, PC A02/MF A01. Order Number DE81028247, Distribution Category STD -27 |
| **DOE/ER/01198-** | | |
| 1354 | 6:33557 | NTIS, PC A02/MF A01. Order Number DE81029681, Distribution Category MN -25 |
| 1367 | 6:33558 | NTIS, PC A04/MF A01. Order Number DE81030944, Distribution Category MN -25 |
| **DOE/ER/02696-** | | |
| 11 | 6:33991 | NTIS, PC A02/MF A01. Order Number DE81030164, Distribution Category MN -34C |
| **DOE/ER/02853-** | | |
| T1 | 6:34000 | NTIS, PC A03/MF A01. Order Number DE81030058, Distribution Category MN -34C |
| **DOE/ER/03023-** | | |
| T1 | 6:33988 | NTIS, PC A03/MF A01. Order Number DE81029086, Distribution Category MN -34D |
| **DOE/ER/03158-** | | |
| 93 | 6:33956 | NTIS, PC A02/MF A01. Order Number DE81030047, Distribution Category MN -34 |
| **DOE/ER/03509-** | | |
| T1 | 6:33966 | NTIS, PC A03/MF A01. Order Number DE81028656, Distribution Category MN -34D |
| **DOE/ER/03992-** | | |
| 448 | 6:34049 | NTIS, PC A02/MF A01. Order Number DE81028472, Distribution Category MN -34D |
| **DOE/ER/04195-** | | |
| 5 | 6:33967 | NTIS, PC A02/MF A01. Order Number DE81030026, Distribution Category MN -34C |
| **DOE/ER/04215-** | | |
| 5 | 6:33992 | NTIS, PC A07/MF A01. Order Number DE81030156, Distribution Category MN -34C |
| **DOE/ER/04660-** | | |
| 1 | 6:33968 | NTIS, PC A02/MF A01. Order Number DE81030025, Distribution Category MN -34 |
| **DOE/ER/05518-** | | |
| 1 | 6:33150 | NTIS, PC A11/MF A01. Order Number DE81030023, Distribution Category MN -64 |
| **DOE/ER/10345-** | | |
| 2 | 6:33080 | NTIS, PC A03/MF A01. Order Number DE81030063, Distribution Category MN -4 |
| **DOE/ER/10472-** | | |
| 1 | 6:33993 | NTIS, PC A05/MF A01. Order Number DE81025937, Distribution Category MN -34C |
| **DOE/ER/10814-** | | |
| 1 | 6:33508 | NTIS, PC A03/MF A01. Order Number DE81028526, Distribution Category MN -25 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| DOE/ER/70035-4 | 6:33994 | NTIS, PC A07/MF A01. Order Number DE81030323, Distribution Category MN -4 |
| DOE/ET/10033-T2 | 6:32906 | NTIS, PC A14/MF A01. Order Number DE81026286, Distribution Category STD -88 |
| DOE/ET/10104-8 | 6:32809 | NTIS, PC A10/MF A01. Order Number DE81029628, Distribution Category STD -90d |
| DOE/ET/10145-72 | 6:32967 | NTIS, PC A08/MF A01. Order Number DE81030441, Distribution Category STD -92a |
| DOE/ET/10154-T14 | 6:32810 | NTIS, PC A03/MF A01. Order Number DE81028419, Distribution Category STD -90d |
| DOE/ET/10325-T11 | 6:32811 | NTIS, PC A03/MF A01. Order Number DE81029123, Distribution Category MN -90c |
| DOE/ET/10415-T4 | 6:33466 | NTIS, PC A03/MF A01. Order Number DE81030157, Distribution Category STD -90e |
| DOE/ET/10593-T2 | 6:32944 | NTIS, PC A02/MF A01. Order Number DE81030329, Distribution Category MN -90e |
| DOE/ET/11268-T3 | 6:32907 | NTIS, PC A07/MF A01. Order Number DE81030279, Distribution Category STD -88 |
| DOE/ET/11343-T2 | 6:33467 | NTIS, PC A07/MF A01. Distribution Category STD -90h |
| DOE/ET/11448-T1 | 6:33254 | NTIS, PC A09/MF A01. Order Number DE81026133, Distribution Category MN -95f |
| DOE/ET/12038-T3 | 6:32968 | NTIS, PC A13/MF A01. Order Number DE81030194, Distribution Category STD -92a |
| DOE/ET/12056-27 | 6:32986 | NTIS, PC A06/MF A01. Order Number DE81030336, Distribution Category STD -92a |
| DOE/ET/12057-8 | 6:32969 | NTIS, PC A06/MF A01. Order Number DE81025797, Distribution Category STD -92a |
| DOE/ET/12394-T2 | 6:32893 | NTIS, PC A03/MF A01. Order Number DE81030390, Distribution Category STD -88 |
| DOE/ET/12532-T4 | 6:32908 | NTIS, PC A02/MF A01. Order Number DE81030376, Distribution Category MN -88 |
| DOE/ET/12542-T1 | 6:32909 | NTIS, PC A09/MF A01. Order Number DE81029742, Distribution Category STD -88 |
| DOE/ET/13060-T9(Vol.2) | 6:32856 | NTIS, PC A10/MF A01. Order Number DE81028444, Distribution Category STD -89 |
| DOE/ET/13113-T2 | 6:33388 | NTIS, PC A06/MF A01. Order Number DE81024167, Distribution Category MN -90 |
| DOE/ET/13511-T8 | 6:33324 | NTIS, PC A02/MF A01. Order Number DE81028914, Distribution Category MN -25 |
| DOE/ET/14356-T1 | 6:33404 | NTIS, PC A05/MF A01. Order Number DE81029241, Distribution Category MN -90b |
| DOE/ET/14674-16 | 6:32812 | NTIS, PC A06/MF A01. Order Number DE81029807, Distribution Category STD -90c |
| DOE/ET/14692-T1 | 6:32902 | NTIS, PC A02/MF A01. Order Number DE81029690, Distribution Category MN -61a |
| T2App.A-D | 6:32896 | NTIS, PC A05/MF A01. Order Number DE81029750, Distribution Category MN -61a |
| T2App.E | 6:32897 | NTIS, PC A07/MF A01. Order Number DE81029658, Distribution Category MN -61a |
| DOE/ET/14693-T3 | 6:32898 | NTIS, PC A03/MF A01. Order Number DE81029642, Distribution Category MN -90 |
| DOE/ET/14696-T6 | 6:33081 | NTIS, PC A11/MF A01. Order Number DE81028299, Distribution Category STD -61a |
| DOE/ET/14700-1 | 6:32813 | NTIS, PC A04/MF A01. Distribution Category STD -90d |
| 2 | 6:32814 | NTIS, PC A04/MF A01. Distribution Category STD -90d |
| DOE/ET/14855-6 | 6:32815 | NTIS, PC A03/MF A01. Distribution Category STD -90c |
| 9 | 6:32816 | NTIS, PC A03/MF A01. Distribution Category STD -90d |
| 12 | 6:32817 | NTIS, PC A03/MF A01. Order Number DE81016136, Distribution Category STD -90d |
| DOE/ET/14943-T1 | 6:32818 | NTIS, PC A12/MF A01. Order Number DE81029631, Distribution Category STD -90d |
| DOE/ET/15078-T9 | 6:33405 | NTIS, PC A04/MF A01. Order Number DE81018491, Distribution Category MN -93 |
| DOE/ET/15299-T1 | 6:32923 | NTIS, PC A03/MF A01. Order Number DE81028123, Distribution Category MN -90b |
| DOE/ET/15426-T7 | 6:33468 | NTIS, PC A03/MF A01. Order Number DE81022152, Distribution Category MN -95f |
| DOE/ET/20077-T1 | 6:33106 | NTIS, PC A07/MF A01. Distribution Category STD -61a |
| DOE/ET/20347-T1 | 6:33124 | NTIS, PC A12/MF A01. Order Number DE81030669, Distribution Category MN -63d |
| DOE/ET/20512-T1 | 6:33909 | NTIS, PC A07/MF A01. Order Number DE81030167, Distribution Category MN -64 |
| DOE/ET/21002-T19 | 6:33151 | NTIS, PC A02/MF A01. Order Number DE81030046, Distribution Category MN -64 |
| DOE/ET/21015-9 | 6:33142 | NTIS, PC A03/MF A01. Order Number DE81029707, Distribution Category MN -62 |
| 11 | 6:33193 | NTIS, PC A04/MF A01. Order Number DE81029713, Distribution Category MN -59c |
| DOE/ET/23047-T2 | 6:33107 | NTIS, PC A04/MF A01. Order Number DE81026765, Distribution Category MN -63e |
| DOE/ET/27167-T1 | 6:33205 | NTIS, PC A04/MF A01. Distribution Category MN -66 |
| DOE/ET/27225-9 | 6:33226 | NTIS, PC A02/MF A01. Order Number DE81028312, Distribution Category MN -66a |

| Report No. | Abstract No. | Availability |
|---|---|---|
| DOE/ET/28359-T1 | 6:33227 | NTIS, PC A11/MF A01. Order Number DE81029037, Distribution Category STD -66 |
| DOE/ET/28443-T15 | 6:33224 | NTIS, PC A06/MF A01. Order Number DE81026271, Distribution Category MN -66f |
| DOE/ET/29335-T1 | 6:33277 | NTIS, PC A04/MF A01. Order Number DE81029626, Distribution Category STD -97a |
| DOE/ET/34031-1 | 6:33291 | NTIS, PC A03/MF A01. Order Number DE81030753, Distribution Category STD -78 |
| 2 | 6:33292 | NTIS, PC A03/MF A01. Order Number DE81030747, Distribution Category STD -78 |
| 3 | 6:33293 | NTIS, PC A02/MF A01. Order Number DE81030748, Distribution Category STD -78 |
| 4 | 6:33294 | NTIS, PC A03/MF A01. Order Number DE81030749, Distribution Category STD -78 |
| 5 | 6:33295 | NTIS, PC A02/MF A01. Order Number DE81030750, Distribution Category STD -78 |
| DOE/ET/34222-1 | 6:33322 | NTIS, PC A07/MF A01. Order Number DE81028353, Distribution Category STD -77 |
| DOE/ET/37227-T1 | 6:33344 | NTIS, PC A04/MF A01. Order Number DE81029708, Distribution Category MN -79p |
| T2 | 6:33345 | NTIS, PC A04/MF A01. Order Number DE81029714, Distribution Category MN -79p |
| T4 | 6:33346 | NTIS, PC A06/MF A01. Order Number DE81029770, Distribution Category MN -79p |
| DOE/ET/37240-74TR | 6:33304 | NTIS, PC A06/MF A01. Order Number DE81029718, Distribution Category MN -79p |
| DOE/ET/41900-5 | 6:33022 | NTIS, PC A03/MF A01. Order Number DE81030154, Distribution Category STD -70 |
| DOE/ET/51013-6 | 6:34171 | NTIS, PC A03/MF A01. Order Number DE81030029, Distribution Category MN -20d |
| DOE/ET/53036-25 | 6:34057 | NTIS, PC A02/MF A01. Order Number DE81029777, Distribution Category MN -20 |
| DOE/EV/03214-T3 | 6:33859 | NTIS, PC A02/MF A01. Order Number DE81030171, Distribution Category MN -48 |
| DOE/EV/03728-T1 | 6:33887 | NTIS, PC A02/MF A01. Order Number DE81030540, Distribution Category MN -48 |
| DOE/EV/04969-3 | 6:33689 | NTIS, PC A02/MF A01. Order Number DE81027995, Distribution Category MN -48 |
| DOE/EV/10072-5 | 6:33206 | NTIS, PC A02/MF A01. Order Number DE81030369, Distribution Category STD -66a |
| DOE/EV/10251-3 | 6:33827 | NTIS, PC A05/MF A01. Order Number DE81030325, Distribution Category MN -11 |
| 4 | 6:33888 | NTIS, PC A02/MF A01. Order Number DE81030324, Distribution Category MN -11 |
| DOE/EV/10539-T1 | 6:33721 | NTIS, PC A03/MF A01. Order Number DE81029841, Distribution Category MN -11 |
| DOE/EV/70024-44 | 6:33820 | NTIS, PC A02/MF A01. Order Number DE81030319, Distribution Category MN -11 |
| DOE/FC/10193-T1 | 6:33742 | NTIS, PC A06/MF A01. Order Number DE81028348, Distribution Category STD -90i |
| DOE/FE/20219-2 | 6:33082 | NTIS, PC A13/MF A01. Order Number DE81030622, Distribution Category MN -90c |
| DOE/ID/01375-T1 | 6:33918 | NTIS, PC A24/MF A01. Order Number DE81028079, Distribution Category MN -41 |
| DOE/JPL-1012-78/ 11 | 6:33108 | NTIS, PC A03/MF A01. Order Number DE81029361, Distribution Category MN -63b |
| DOE/JPL/954334-19 | 6:33109 | NTIS, PC A03/MF A01. Order Number DE81028196, Distribution Category STD -63b |
| DOE/JPL/954355-81-18 | 6:33110 | NTIS, PC A04/MF A01. Order Number DE81029907, Distribution Category STD -63b |
| DOE/JPL/955089-81/ 11 | 6:33111 | NTIS, PC A05/MF A01. Order Number DE81029905, Distribution Category STD -63b |
| DOE/JPL/955733-T1 | 6:33112 | NTIS, PC A02/MF A01. Order Number DE81028929, Distribution Category STD -63b |
| DOE/JPL/955894-2 | 6:33125 | NTIS, PC A05/MF A01. Order Number DE81021535, Distribution Category STD -63b |
| DOE/JPL/955902-81/ 2 | 6:33113 | NTIS, PC A04/MF A01. Order Number DE81024349, Distribution Category STD -63b |
| DOE/MC/11577-T23 | 6:32992 | NTIS, PC A07/MF A01. Order Number DE81027463, Distribution Category STD -92a |
| DOE/MC/14784-T1 | 6:32866 | NTIS, PC A03/MF A01. Order Number DE81028930, Distribution Category MN -90i |
| DOE/METC/SP-110 | 6:32819 | NTIS, PC A03/MF A01. Order Number DE81030183, Distribution Category STD -90c |
| 183 | 6:32820 | NTIS, PC A04/MF A01. Order Number DE81030184, Distribution Category STD -90c |
| DOE/MI/01006-T1-Pt.1 | 6:32980 | NTIS, PC A05/MF A01. Order Number DE81029974, Distribution Category MN -98B |
| T1-Pt.2 | 6:32981 | NTIS, PC A08/MF A01. Order Number DE81029980, Distribution Category MN -98B |
| DOE/NASA/0051-2 | 6:33435 | NTIS, PC A12/MF A01. Order Number DE81030882, Distribution Category STD -90g |
| DOE/NASA/0161-7 | 6:33439 | NTIS, PC A06/MF A01. Order Number DE81030874, Distribution Category MN -90f |
| DOE/NASA/0176-81/ 2 | 6:33440 | NTIS, PC A03/MF A01. Order Number DE81030345, Distribution Category MN -93 |
| DOE/NASA/1011-34 | 6:33486 | NTIS, PC A02/MF A01. Order Number DE81028520, Distribution Category STD -96 |
| DOE/NASA/1062-9 | 6:33438 | NTIS, PC A03/MF A01. Order Number DE81030432, Distribution Category STD -90f |

| Report No. | Abstract No. | Availability |
|---|---|---|
| DOE/NASA/2593-22 | 6:33509 | NTIS, PC A02/MF A01. Order Number DE81030378, Distribution Category STD -90h |
| DOE/NASA/3303-1 | 6:33241 | NTIS, PC A04/MF A01. Order Number DE81030416, Distribution Category STD -60 |
| DOE/NASA/12726-13 | 6:33441 | NTIS, PC A02/MF A01. Order Number DE81029959, Distribution Category STD -94c |
| DOE/NASA/51040-22 | 6:33487 | NTIS, PC A04/MF A01. Order Number DE81030418, Distribution Category STD -96 |
| 31 | 6:33490 | NTIS, PC A03/MF A01. Order Number DE81030834, Distribution Category STD -96 |
| DOE/NASA/CR-161830 | 6:33164 | NTIS, PC A08/MF A01. Order Number DE81030142, Distribution Category STD -59c |
| DOE/NV/10039-3 | 6:33207 | NTIS, PC A10/MF A01. Order Number DE81030487, Distribution Category STD -66a |
| 3 | 6:33208 | NTIS, PC A10/MF A01. Order Number DE81030487 |
| 3 | 6:33215 | NTIS, PC A10/MF A01. Order Number DE81030487 |
| 3 | 6:33216 | NTIS, PC A10/MF A01. Order Number DE81030487 |
| 3 | 6:33217 | NTIS, PC A10/MF A01. Order Number DE81030487 |
| DOE/OR/03054-3 | 6:32821 | NTIS, PC A11/MF A01. Order Number DE81027430, Distribution Category MN -89 |
| 3 | 6:32822 | NTIS, PC A11/MF A01 |
| 3 | 6:32823 | NTIS, PC A11/MF A01 |
| 3 | 6:32824 | NTIS, PC A11/MF A01 |
| 3 | 6:32825 | NTIS, PC A11/MF A01 |
| 3 | 6:32826 | NTIS, PC A11/MF A01 |
| 3 | 6:32827 | NTIS, PC A11/MF A01 |
| 3 | 6:32828 | NTIS, PC A11/MF A01 |
| 3 | 6:32829 | NTIS, PC A11/MF A01 |
| 3 | 6:32830 | NTIS, PC A11/MF A01 |
| DOE/OR/06074-1-Vol.3 | 6:33335 | NTIS, PC A12/MF A01. Order Number DE81027337, Distribution Category MN -78 |
| DOE/OR/90337-T1 | 6:33368 | NTIS, PC A10/MF A01. Order Number DE81030349, Distribution Category MN -94b |
| DOE/PC/30021-T4 | 6:32831 | NTIS, PC A03/MF A01. Order Number DE81028209, Distribution Category STD -90d |
| DOE/PC/30041-T5 | 6:32832 | NTIS, PC A02/MF A01. Order Number DE81025961, Distribution Category MN -90d |
| T6 | 6:32833 | NTIS, PC A02/MF A01. Order Number DE81029125, Distribution Category MN -90d |
| DOE/PC/30080-4 | 6:32834 | NTIS, PC A04/MF A01. Order Number DE81030492, Distribution Category STD -90d |
| DOE/PC/30233-T2 | 6:32867 | NTIS, PC A03/MF A01. Order Number DE81026280, Distribution Category STD -90i |
| DOE/PC/30295-3 | 6:32945 | NTIS, PC A04/MF A01. Order Number DE81029071, Distribution Category MN -90e |
| DOE/PC/30298-T3 | 6:33743 | NTIS, PC A03/MF A01. Order Number DE81028391, Distribution Category MN -90i |
| DOE/PC/30301-3 | 6:32946 | NTIS, PC A03/MF A01. Order Number DE81027490, Distribution Category MN -90e |
| DOE/PC/30304-2 | 6:33083 | NTIS, PC A02/MF A01. Order Number DE81030273, Distribution Category MN -90i |
| DOE/PC/30307-3 | 6:32947 | NTIS, PC A02/MF A01. Order Number DE81027961, Distribution Category MN -90i |
| DOE/PC/40266-1 | 6:32859 | NTIS, PC A03/MF A01. Order Number DE81030277, Distribution Category MN -90a |
| DOE/PC/40787-1 | 6:32860 | NTIS, PC A02/MF A01. Order Number DE81029481, Distribution Category MN -90d |
| DOE/PR/06010-T7 | 6:32835 | NTIS, PC A03/MF A01. Order Number DE81029477, Distribution Category MN -90h |
| DOE/QQ/04038-T1 | 6:33165 | NTIS, PC A06/MF A01. Order Number DE81029667, Distribution Category MN -59 |
| DOE/R5/10223-2 | 6:33194 | NTIS, PC A03/MF A01. Order Number DE81028152, Distribution Category MN -59c |
| DOE/R5/10226-1 | 6:33242 | NTIS, PC A05/MF A01. Order Number DE81030950, Distribution Category MN -60 |
| DOE/RA/20029-T1 | 6:32899 | NTIS, PC A05/MF A01. Order Number DE81030895, Distribution Category MN -88 |
| DOE/RA/20222-2 | 6:32836 | NTIS, PC A20/MF A01. Order Number DE81028355, Distribution Category MN -90c |
| DOE/RL/01830-T6 | 6:33373 | NTIS, PC A03/MF A01. Order Number DE81030263, Distribution Category STD -94a |
| DOE/RL/10119-1 | 6:33023 | NTIS, PC A04/MF A01. Order Number DE81030318, Distribution Category MN -70 |
| DOE/SF/10748-T2 | 6:33300 | NTIS, PC A06/MF A01. Order Number DE81024220, Distribution Category MN -77 |
| DOE/SF/10852-T1 | 6:32996 | NTIS, PC A04/MF A01. Order Number DE81030491, Distribution Category MN -91 |
| DOE/SF/11446-T1 | 6:33191 | NTIS, PC A02/MF A01. Order Number DE81028302, Distribution Category STD -59 |
| DOE/SF/11511-T1 | 6:33166 | NTIS, PC A06/MF A01. Order Number DE81022181, Distribution Category MN -59b |
| DOE/SF/70097-T8 | 6:33347 | NTIS, PC A02/MF A01. Order Number DE81027046, Distribution Category MN -79p |
| DOE/SR/01069-1 | 6:33018 | NTIS, PC A10/MF A01. Order Number DE81030483, Distribution Category STD -85 |
| DOE/SR/10018-5 | 6:33807 | NTIS, PC A06/MF A01. Order Number DE81028078, Distribution Category MN -11 |
| DOE/SR/10706-1 | 6:33886 | NTIS, PC A02/MF A01. Order Number DE81030836, Distribution Category MN -11 |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| **DOE/TIC-** | | |
| 11477 | 6:32910 | NTIS, PC A02/MF A01. Order Number DE81028714, Distribution Category STD -88 |
| 11481 | 6:32911 | NTIS, PC A03/MF A01. Order Number DE81028719, Distribution Category STD -88 |
| 11482 | 6:32924 | NTIS, PC A02/MF A01. Order Number DE81028718, Distribution Category STD -88 |
| 1027977 | 6:33167 | NTIS, PC A08/MF A01. Order Number DE81027977, Distribution Category MN -59 |
| **DOE/UMT-** | | |
| 012 | 6:33024 | NTIS, PC A04/MF A01. Order Number DE81030508, Distribution Category MN -70 |
| 012S | 6:33025 | NTIS, PC A04/MF A01. Order Number DE81030509, Distribution Category MN -70 |
| 0104 | 6:33026 | NTIS, PC A10/MF A01. Order Number DE81030510, Distribution Category MN -70 |
| 0104S | 6:33027 | NTIS, PC A04/MF A01. Order Number DE81030511, Distribution Category MN -70 |
| **DP-** | | |
| 1577 | 6:33572 | NTIS, PC A03/MF A01. Order Number DE81030751, Distribution Category STD -10 |
| **DP-MS-** | | |
| 81-12 | 6:33654 | NTIS, PC A03/MF A01. Order Number DE81030521, Distribution Category MN -23 |
| 81-18 | 6:33028 | NTIS, PC A02/MF A01. Order Number DE81028380, Distribution Category MN -25 |
| **DPSPU-** | | |
| 81-30-1 | 6:33801 | NTIS, PC A04/MF A01. Order Number DE81030366, Distribution Category MN -11 |
| **DPST-** | | |
| 80-128-4 | 6:33070 | NTIS, PC A04/MF A01. Order Number DE81030522, Distribution Category MN -23 |
| 81-262 | 6:33029 | NTIS, PC A06/MF A01. Order Number DE81025589, Distribution Category MN -70 |
| 81-262 | 6:33030 | NTIS, PC A06/MF A01 |
| 81-262 | 6:33031 | NTIS, PC A06/MF A01 |
| 81-262 | 6:33032 | NTIS, PC A06/MF A01 |
| 81-262 | 6:33033 | NTIS, PC A06/MF A01 |
| 81-262 | 6:33348 | NTIS, PC A06/MF A01 |
| 81-262 | 6:33924 | NTIS, PC A06/MF A01 |
| 81-262 | 6:33925 | NTIS, PC A06/MF A01 |
| 81-262 | 6:33926 | NTIS, PC A06/MF A01 |
| 81-262 | 6:33927 | NTIS, PC A06/MF A01 |
| **EGG-** | | |
| 1183-1777 | 6:33697 | NTIS, PC A02/MF A01. Order Number DE81029740, Distribution Category MN -38 |
| 2110 | 6:33225 | NTIS, PC A03/MF A01. Order Number DE81030200, Distribution Category STD -66 |
| **EGG-M-** | | |
| 02781 | 6:33089 | NTIS, PC A02/MF A01. Order Number DE81028271, Distribution Category MN -97e |
| **EMD-** | | |
| 2-68-2207 | 6:33233 | New Mexico Energy and Minerals Dept., Santa Fe |
| 81-50 | 6:33420 | General Accounting Office, Gaithersburg, MD. Distribution Category MN -97 |
| 81-53 | 6:33385 | General Accounting Office, Gaithersburg, MD. Distribution Category MN -13 |
| **ENDF-** | | |
| 294 | 6:34038 | *See* BNL-NCS-51346 |
| 310 | 6:34028 | *See* ORNL/TM-7883 |
| 314 | 6:33323 | *See* LA-8950-MS |
| **EPA-** | | |
| 600/ 7-81-118 | 6:33738 | *See* CONF-801259- |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| **EPA/600-** | | |
| 4-81-047 | 6:33802 | NTIS, PC A06/MF A01. Order Number DE81030214, Distribution Category STD -41 |
| **EPRI-AP-** | | |
| 1422-Vol.2 | 6:33255 | NTIS, PC A21/MF A01. Order Number DE82900084, Distribution Category MN -90c |
| 1422-Vol.3 | 6:33256 | NTIS, PC A07/MF A01. Order Number DE82900247, Distribution Category MN -90c |
| 1889(Vol.1) | 6:33257 | NTIS, PC A11/MF A01. Order Number DE81904245, Distribution Category MN -93 |
| 1889-Vol.2 | 6:33258 | NTIS, PC A99/MF A01. Order Number DE81904229, Distribution Category MN -93 |
| 1933 | 6:33259 | NTIS, PC A11/MF A01. Order Number DE81904240, Distribution Category MN -90f |
| 1943 | 6:33260 | NTIS, PC A11/MF A01. Order Number DE81904206, Distribution Category MN -90f |
| 1955 | 6:33547 | NTIS, PC A07/MF A01. Order Number DE81904208, Distribution Category MN -90f |
| **EPRI-CS-** | | |
| 1838 | 6:33261 | NTIS, PC A08/MF A01. Order Number DE81903783, Distribution Category MN -12 |
| 1935 | 6:33660 | NTIS, PC A21/MF A01. Order Number DE81904226, Distribution Category MN -90h |
| 1938 | 6:33262 | NTIS, PC A12/MF A01. Order Number DE81904232, Distribution Category MN -90h |
| 1958 | 6:33573 | NTIS, PC A04/MF A01. Order Number DE81904189, Distribution Category MN -90h |
| 1983-Vol.1 | 6:33088 | NTIS, PC A11/MF A01. Order Number DE81904238, Distribution Category MN -90h |
| 1984 | 6:32869 | NTIS, PC A07/MF A01. Order Number DE81904200, Distribution Category MN -90i |
| 1992(Vol.1) | 6:33469 | NTIS, PC A03/MF A01. Order Number DE81904258, Distribution Category MN -90i |
| 1995 | 6:32989 | NTIS, PC A05/MF A01. Order Number DE81904193, Distribution Category MN -90i |
| 2009(Vol.3) | 6:32870 | NTIS, PC A03/MF A01. Order Number DE81904224, Distribution Category MN -90i |
| **EPRI-EA-** | | |
| 270 | 6:33744 | NTIS, PC A07/MF A01. Order Number DE82900004, Distribution Category MN -90i |
| 1672(Vol.2) | 6:33421 | NTIS, PC A06/MF A01. Order Number DE81904252, Distribution Category MN -98F |
| 1672(Vol.3) | 6:33422 | NTIS, PC A13/MF A01. Order Number DE81904192, Distribution Category MN -97 |
| 1807 | 6:33423 | NTIS, PC A15/MF A01. Order Number DE81904191, Distribution Category MN -98E |
| 1956(Vol.1) | 6:33470 | NTIS, PC A09/MF A01. Order Number DE81904220, Distribution Category MN -98G |
| 1964(Vol.1) | 6:33424 | NTIS, PC A04/MF A01. Order Number DE81904241, Distribution Category MN -90e |
| 1964-Vol.2 | 6:33425 | NTIS, PC A05/MF A01. Order Number DE81904246, Distribution Category MN -90e |
| 1964(Vol.3) | 6:33426 | NTIS, PC A06/MF A01. Order Number DE81904237, Distribution Category MN -90e |
| 1988 | 6:33794 | NTIS, PC A06/MF A01. Order Number DE81904201, Distribution Category MN -11 |
| 1989 | 6:33821 | NTIS, PC A09/MF A01. Order Number DE81030674, Distribution Category MN -11 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 1994(Vol.2) | 6:33910 | NTIS, PC A16/MF A01. Order Number DE81904207, Distribution Category MN -48 |
| **EPRI-EL-** | | |
| 1946 | 6:33278 | NTIS, PC A07/MF A01. Order Number DE81904209, Distribution Category MN -97a |
| 1949 | 6:33279 | NTIS, PC A08/MF A01. Order Number DE81904233, Distribution Category MN -97a |
| 1970(Vol.1) | 6:33280 | NTIS, PC A08/MF A01. Order Number DE81904195, Distribution Category MN -97b |
| 1970(Vol.2) | 6:33281 | NTIS, PC A13/MF A01. Order Number DE81904210, Distribution Category MN -97b |
| 2016 | 6:33282 | NTIS, PC A08/MF A01. Order Number DE81904213, Distribution Category MN -97a |
| **EPRI-EM-** | | |
| 230 | 6:33263 | NTIS, PC A05/MF A01. Order Number DE82900234, Distribution Category MN -94cc |
| 1589(Vol.8) | 6:33371 | NTIS, PC A11/MF A01. Order Number DE81030673, Distribution Category MN -94e |
| 1589(Vol.9) (App.C) | 6:33369 | NTIS, PC A06/MF A01. Order Number DE81030672, Distribution Category MN -94e |
| 1968(Vol.1) | 6:33477 | NTIS, PC A09/MF A01. Order Number DE81904212, Distribution Category MN -97d |
| 1968(Vol.2) | 6:33478 | NTIS, PC A05/MF A01. Order Number DE81904236, Distribution Category MN -97d |
| 1996 | 6:32970 | NTIS, PC A04/MF A01. Order Number DE81904202, Distribution Category MN -92a |
| **EPRI-FP-** | | |
| 207 | 6:33270 | NTIS, PC A08/MF A01. Order Number DE82900023, Distribution Category MN -90i |
| **EPRI-NP-** | | |
| 1899 | 6:33349 | NTIS, PC A11/MF A01. Order Number DE81904219, Distribution Category MN -80 |
| 1920 | 6:33319 | NTIS, PC A11/MF A01. Order Number DE81904196, Distribution Category MN -78 |
| 1931 | 6:33510 | NTIS, PC A11/MF A01. Order Number DE81904218, Distribution Category MN -80 |
| 1945(Vol.2) | 6:33350 | NTIS, PC A06/MF A01. Order Number DE81904194, Distribution Category MN -80 |
| 1969-SR | 6:33289 | NTIS, PC A07/MF A01. Order Number DE81904244, Distribution Category MN -80 |
| 1973 | 6:33305 | NTIS, PC A11/MF A01. Order Number DE81904203, Distribution Category MN -80 |
| 1982 | 6:33333 | NTIS, PC A09/MF A01. Order Number DE81904239, Distribution Category MN -80 |
| 1986 | 6:33306 | NTIS, PC A04/MF A01. Order Number DE81904222, Distribution Category MN -79a |
| 1999(Vol.1) | 6:33351 | NTIS, PC A10/MF A01. Order Number DE81904215, Distribution Category MN -78 |
| 1999(Vol.2) | 6:33352 | NTIS, PC A08/MF A01. Order Number DE81904221, Distribution Category MN -78 |
| **EPRI-WS-** | | |
| 79-182 | 6:32961 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:32982 | NTIS, PC A13/MF A01. Order Number DE81904250, Distribution Category MN -98B |
| 79-182 | 6:32983 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:33406 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:33407 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:33408 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:33409 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:33410 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:33411 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:33412 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:33413 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:33414 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:33415 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:33416 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-182 | 6:33417 | NTIS, PC A13/MF A01. Order Number DE81904250 |
| 79-236 | 6:32871 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32872 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32873 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32874 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32875 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32876 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32877 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32894 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32925 | NTIS, PC A99/MF A01. Order Number DE81904230, Distribution Category MN -90b |
| 79-236 | 6:32926 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32927 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32928 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32929 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32930 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32931 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32932 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32933 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32934 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32935 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32936 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32937 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32938 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32939 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| 79-236 | 6:32940 | NTIS, PC A99/MF A01. Order Number DE81904230 |
| **ERDA-** | | |
| 77-9 | 6:33204 | NTIS, PC A15/MF A01. Order Number DE81029873, Distribution Category MN -66 |
| 80 | 6:33290 | NTIS, PC A99/MF A01. Order Number DE81029851, Distribution Category MN -80 |
| **ESG-DOE-** | | |
| 13345 | 6:33022 | *See* DOE/ET/41900-5 |
| **FE-** | | |
| 2018-19 | 6:32944 | *See* DOE/ET/10593-T2 |
| 2542-40(Vol.2) | 6:32856 | *See* DOE/ET/13060-T9(Vol.2) |
| 3120-1 | 6:32906 | *See* DOE/ET/10033-T2 |
| **FEA/B-** | | |
| 77/ 226 | 6:33381 | *See* NTISUB/C-221-404 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **FEMA-** | | |
| 2563F | 6:33717 | Federal Emergency Management Agency, Washington, DC. Distribution Category MN -2 |
| **GA-A-** | | |
| 16384 | 6:34172 | NTIS, PC A02/MF A01. Order Number DE81029132, Distribution Category MN -20c |
| 16400 | 6:34058 | NTIS, PC A03/MF A01. Order Number DE81029891, Distribution Category MN -20g |
| 16418 | 6:34059 | NTIS, PC A03/MF A01. Order Number DE81029892, Distribution Category MN -20g |
| 16441 | 6:34060 | NTIS, PC A02/MF A01. Order Number DE81029889, Distribution Category MN -20g |
| **GEFR-SP-** | | |
| 236 | 6:33308 | NTIS, PC A03/MF A01. Order Number DE81029897, Distribution Category MN -79b |
| **GEND-** | | |
| 010-Vol.1 | 6:33353 | NTIS, PC A05/MF A01. Order Number DE81029492, Distribution Category STD -78 |
| **GEPP-TIS-** | | |
| 587 | 6:33069 | NTIS, PC A03/MF A01. Order Number DE81030694, Distribution Category MN -13 |
| **GJBX-** | | |
| 125(81) | 6:33001 | NTIS, PC A03/MF A01. Order Number DE81027159, Distribution Category MN -51 |
| 182(81) | 6:33391 | NTIS, PC A03/MF A01. Order Number DE81025509, Distribution Category MN -51 |
| 218-81 | 6:33002 | NTIS, PC E12/MF A01. Order Number DE81027988, Distribution Category MN -51 |
| 219-81 | 6:33003 | NTIS, PC E10/MF A01. Order Number DE81027866, Distribution Category MN -51 |
| 229-81 | 6:33004 | NTIS, PC A12/MF A01. Order Number DE81028638, Distribution Category MN -51 |
| 241-81-Vol.1 | 6:33005 | NTIS, PC E10/MF, $16.10. Order Number DE81028641, Distribution Category MN -51 |
| 243-81 | 6:33006 | NTIS, PC A04/MF A01. Order Number DE81028166, Distribution Category MN -51 |
| 272-81 | 6:33007 | NTIS, PC E03/MF A01. Order Number DE81030292, Distribution Category MN -51 |
| 275-81 | 6:33008 | NTIS, PC E04/MF A01. Order Number DE81030294, Distribution Category MN -51 |
| 276-81 | 6:33009 | NTIS, PC E05/PC A01. Order Number DE81030289, Distribution Category MN -51 |
| 277-81 | 6:33010 | NTIS, PC E04/MF A01. Order Number DE81030281, Distribution Category MN -51 |
| 278-81 | 6:33011 | NTIS, PC E04/MF A01. Order Number DE81030290, Distribution Category MN -51 |
| 279-81 | 6:33012 | NTIS, PC E04/MF A01. Order Number DE81030291, Distribution Category MN -51 |
| **HCP/M-** | | |
| 4038-02-Rev. | 6:33165 | *See* DOE/QQ/04038-T1 |
| **HCP/P7405-** | | |
| 01 | 6:33399 | *See* LBL-6831-Rev. |
| **HEDL-SA-** | | |
| 2201-FP | 6:33635 | NTIS, PC A03/MF A01. Order Number DE81029758, Distribution Category MN -79g |
| 2263-FP | 6:33354 | NTIS, PC A02/MF A01. Order Number DE81029759, Distribution Category MN -79p |
| 2264-FP | 6:33355 | NTIS, PC A02/MF A01. Order Number DE81029760, Distribution Category MN -79p |
| 2272 | 6:33356 | NTIS, PC A02/MF A01. Order Number DE81029761, Distribution Category MN -79p |
| 2284-FP | 6:33357 | NTIS, PC A02/MF A01. Order Number DE81029795, Distribution Category MN -79b |
| 2288-S | 6:33358 | NTIS, PC A02/MF A01. Order Number DE81029794, Distribution Category MN -79b |
| 2292-FP | 6:33359 | NTIS, PC A02/MF A01. Order Number DE81029783, Distribution Category MN -79p |
| 2312-FP | 6:33336 | NTIS, PC A02/MF A01. Order Number DE81025304, Distribution Category MN -79b |
| 2317 | 6:33511 | NTIS, PC A02/MF A01. Order Number DE81028170, Distribution Category MN -79h |
| 2330-Rev.1 | 6:33337 | NTIS, PC A02/MF A01. Order Number DE81025295, Distribution Category MN -79b |
| 2333-FP | 6:33309 | NTIS, PC A02/MF A01. Order Number DE81029801, Distribution Category MN -79b |
| 2338-FP | 6:33512 | NTIS, PC A02/MF A01. Order Number DE81029800, Distribution Category MN -20c |
| 2340FP | 6:34173 | NTIS, PC A02/MF A01. Order Number DE81029803, Distribution Category MN -20c |
| 2341 | 6:33513 | NTIS, PC A02/MF A01. Order Number DE81029804, Distribution Category MN -20c |
| 2342-FP | 6:33514 | NTIS, PC A02/MF A01. Order Number DE81029805, Distribution Category MN -20c |
| 2357 | 6:33515 | NTIS, PC A02/MF A01. Order Number DE81029780, Distribution Category MN -20c |
| 2359 | 6:33516 | NTIS, PC A02/MF A01. Order Number DE81029754, Distribution Category MN -20c |
| 2371 | 6:33310 | NTIS, PC A02/MF A01. Order Number DE81029779, Distribution Category MN -79 |
| 2386 | 6:33311 | NTIS, PC A02/MF A01. Order Number DE81029810, Distribution Category MN -79 |
| 2475 | 6:33517 | NTIS, PC A02/MF A01. Order Number DE81029757, Distribution Category MN -20c |
| 2476-FP | 6:34174 | NTIS, PC A02/MF A01. Order Number DE81029775, Distribution Category MN -20c |
| **IS-M-** | | |
| 329 | 6:33559 | NTIS, PC A02/MF A01. Order Number DE81025526, Distribution Category MN -34 |
| 330 | 6:32861 | NTIS, PC A02/MF A01. Order Number DE81025527, Distribution Category MN -90 |
| 334 | 6:33168 | NTIS, PC A02/MF A01. Order Number DE81028925, Distribution Category MN -4 |
| 337 | 6:33059 | NTIS, PC A02/MF A01. Order Number DE81029615, Distribution Category MN -4 |
| 338 | 6:33518 | NTIS, PC A02/MF A01. Order Number DE81029838, Distribution Category MN -25 |
| 345 | 6:33169 | NTIS, PC A02/MF A01. Order Number DE81029821, Distribution Category MN -62 |
| **IS-T-** | | |
| 898 | 6:33574 | NTIS, PC A07/MF A01. Order Number DE81030744, Distribution Category MN -4 |
| 914 | 6:33575 | NTIS, PC A14/MF A01. Order Number DE81030743, Distribution Category MN -4 |
| 918 | 6:33519 | NTIS, PC A05/MF A01. Order Number DE81030745, Distribution Category MN -25 |
| 926 | 6:33520 | NTIS, PC A07/MF A01. Order Number DE81030746, Distribution Category MN -34 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **K/OA-** | | |
| 5014-Rev.1 | 6:33576 | NTIS, PC A02/MF A01. Order Number DE81030818, Distribution Category MN -15 |
| **K/RA-** | | |
| 106 | 6:33919 | NTIS, PC A02/MF A01. Order Number DE81029862, Distribution Category MN -41 |
| **K/SUB-** | | |
| 13876-81/ 1 | 6:33046 | NTIS, PC A03/MF A01. Order Number DE81029526, Distribution Category MN -41 |
| **K/UR-** | | |
| 34-Suppl.1 | 6:33006 | *See* GJBX-243-81 |
| 152 | 6:33004 | *See* GJBX-229-81 |
| 153 | 6:33002 | *See* GJBX-218-81 |
| 155 | 6:33003 | *See* GJBX-219-81 |
| 337 | 6:33007 | *See* GJBX-272-81 |
| 349 | 6:33008 | *See* GJBX-275-81 |
| 352 | 6:33009 | *See* GJBX-276-81 |
| 355 | 6:33010 | *See* GJBX-277-81 |
| 357 | 6:33011 | *See* GJBX-278-81 |
| 358 | 6:33012 | *See* GJBX-279-81 |
| **KMSF-U-** | | |
| 1109 | 6:34061 | NTIS, PC A02/MF A01. Order Number DE81029627, Distribution Category MN -21 |
| **LA-** | | |
| 6647-MS | 6:33013 | NTIS, PC A05/MF A01. Order Number DE81029139, Distribution Category MN -51 |
| 8114-PR | 6:34175 | NTIS, PC A09/MF A01. Order Number DE81030512, Distribution Category STD -21 |
| 8621-MS | 6:33060 | NTIS, PC A03/MF A01. Order Number DE81030503, Distribution Category STD -15 |
| 8720 | 6:33698 | NTIS, PC A02/MF A01. Order Number DE81030421, Distribution Category STD -37 |
| 8792-MS | 6:32995 | NTIS, PC A03/MF A01. Order Number DE81032017, Distribution Category STD -91 |
| 8807-MS | 6:33014 | NTIS, PC A09/MF A01. Order Number DE81030499, Distribution Category MN -51 |
| 8855-HDR | 6:33228 | NTIS, PC A10/MF A01. Order Number DE81028517, Distribution Category STD -66a |
| 8861-UMT | 6:33035 | NTIS, PC A02/MF A01. Order Number DE81032025, Distribution Category STD -11 |
| 8894-MS | 6:33636 | NTIS, PC A03/MF A01. Order Number DE81030502, Distribution Category STD -90 |
| 8904-PR | 6:33071 | NTIS, PC A02/MF A01. Order Number DE81030501, Distribution Category STD -23 |
| 8921-MS | 6:34044 | NTIS, PC A03/MF A01. Order Number DE81030387, Distribution Category STD -32 |
| 8930-MS | 6:33708 | NTIS, PC A03/MF A01. Order Number DE81030438, Distribution Category STD -45 |
| 8937-T | 6:33997 | NTIS, PC A06/MF A01. Order Number DE81030505, Distribution Category STD -34C |
| 8938-MS | 6:33745 | NTIS, PC A02/MF A01. Order Number DE81030506, Distribution Category STD -11 |
| 8950-MS | 6:33323 | NTIS, PC A05/MF A01. Order Number DE81032021, Distribution Category STD -34C |
| 8954-MS | 6:33229 | NTIS, PC A03/MF A01. Order Number DE81032024, Distribution Category STD -66a |
| 8957-MS | 6:33577 | NTIS, PC A02/MF A01. Order Number DE81032023, Distribution Category STD -15 |
| 8967-PR | 6:33036 | NTIS, PC A02/MF A01. Order Number DE81032022, Distribution Category STD -51 |
| 8968-PR | 6:33072 | NTIS, PC A02/MF A01. Order Number DE81030504, Distribution Category STD -23 |
| 8969-MS | 6:33061 | NTIS, PC A02/MF A01. Order Number DE81030852, Distribution Category STD -16 |
| 8971-MS | 6:33360 | NTIS, PC A02/MF A01. Order Number DE81030780, Distribution Category STD -34 |
| **LA-tr-** | | |
| 81-19 | 6:33646 | NTIS, PC A02/MF A01. Order Number DE81024201, Distribution Category MN -38 |
| 81-19 | 6:33646 | NTIS, PC A02/MF A01. Order Number DE81024201, Distribution Category MN -38 |
| 81-23 | 6:33718 | NTIS, PC A02/MF A01. Order Number DE81028977, Distribution Category MN -35 |
| 81-23 | 6:33718 | NTIS, PC A02/MF A01. Order Number DE81028977, Distribution Category MN -35 |
| **LA-UR-** | | |
| 81-1765 | 6:33218 | NTIS, PC A02/MF A01. Order Number DE81025371, Distribution Category MN -66b |
| 81-1807 | 6:33219 | NTIS, PC A02/MF A01. Order Number DE81025305, Distribution Category MN -66a |
| 81-1821 | 6:33016 | NTIS, PC A03/MF A01. Order Number DE81030283, Distribution Category MN -22 |
| 81-1835 | 6:33709 | NTIS, PC A02/MF A01. Order Number DE81025252, Distribution Category MN -45 |
| 81-2410 | 6:33995 | NTIS, PC A02/MF A01. Order Number DE81030115, Distribution Category MN -34C |
| 81-2426 | 6:33521 | NTIS, PC A02/MF A01. Order Number DE81030113, Distribution Category MN -35 |
| 81-2437 | 6:33522 | NTIS, PC A02/MF A01. Order Number DE81030112, Distribution Category MN -20c |
| 81-2444 | 6:33523 | NTIS, PC A02/MF A01. Order Number DE81030111, Distribution Category MN -25 |
| 81-2451 | 6:33015 | NTIS, PC A02/MF A01. Order Number DE81030110, Distribution Category MN -51 |
| 81-2455 | 6:33524 | NTIS, PC A02/MF A01. Order Number DE81030109, Distribution Category MN -25 |
| 81-2456 | 6:33525 | NTIS, PC A02/MF A01. Order Number DE81030108, Distribution Category MN -25 |
| 81-2468 | 6:34176 | NTIS, PC A02/MF A01. Order Number DE81030257, Distribution Category MN -21 |
| 81-2469 | 6:34177 | NTIS, PC A02/MF A01. Order Number DE81030256, Distribution Category MN -21 |
| 81-2473 | 6:33957 | NTIS, PC A02/MF A01. Order Number DE81030255, Distribution Category MN -25 |
| 81-2477 | 6:33073 | NTIS, PC A02/MF A01. Order Number DE81030253, Distribution Category MN -4 |
| 81-2482 | 6:33710 | NTIS, PC A02/MF A01. Order Number DE81030252, Distribution Category MN -45 |
| 81-2500 | 6:33170 | NTIS, PC A02/MF A01. Order Number DE81030250, Distribution Category MN -59 |
| 81-2505 | 6:33934 | NTIS, PC A02/MF A01. Order Number DE81030249, Distribution Category MN -34B |
| 81-2518 | 6:33171 | NTIS, PC A02/MF A01. Order Number DE81030247, Distribution Category MN -59 |
| 81-2523 | 6:34178 | NTIS, PC A02/MF A01. Order Number DE81030139, Distribution Category MN -21 |
| 81-2524 | 6:34179 | NTIS, PC A02/MF A01. Order Number DE81030138, Distribution Category MN -21 |
| 81-2530 | 6:33619 | NTIS, PC A04/MF A01. Order Number DE81030136, Distribution Category MN -22 |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| 81-2531 | 6:33578 | NTIS, PC A02/MF A01. Order Number DE81030135, Distribution Category MN -37 |
| 81-2568 | 6:33648 | NTIS, PC A02/MF A01. Order Number DE81030132, Distribution Category MN -21 |
| 81-2571 | 6:33671 | NTIS, PC A02/MF A01. Order Number DE81030245, Distribution Category MN -38 |
| 81-2572 | 6:34062 | NTIS, PC A02/MF A01. Order Number DE81030244, Distribution Category MN -20a |
| 81-2575 | 6:33935 | NTIS, PC A02/MF A01. Order Number DE81030243, Distribution Category MN -34B |
| 81-2584 | 6:33037 | NTIS, PC A02/MF A01. Order Number DE81030242, Distribution Category MN -70 |
| 81-2591 | 6:33936 | NTIS, PC A02/MF A01. Order Number DE81030240, Distribution Category MN -34B |
| 81-2595 | 6:33317 | NTIS, PC A02/MF A01. Order Number DE81030239, Distribution Category MN -33 |
| 81-2622 | 6:32987 | NTIS, PC A02/MF A01. Order Number DE81030237, Distribution Category MN -92 |
| 81-2628 | 6:33074 | NTIS, PC A02/MF A01. Order Number DE81030235, Distribution Category MN -4 |
| 81-2635 | 6:33983 | NTIS, PC A02/MF A01. Order Number DE81030234, Distribution Category MN -34D |
| **LALP-** | | |
| 81-29 | 6:33962 | NTIS, PC A03/MF A01. Order Number DE81030500, Distribution Category MN -13 |
| **LBL-** | | |
| 6831-Rev. | 6:33399 | NTIS, PC A14/MF A01. Order Number DE81029849, Distribution Category MN -13 |
| 10511-Vol.1 | 6:33152 | NTIS, PC A10/MF A01. Order Number DE81030222, Distribution Category STD -64 |
| 10511-Vol.2 | 6:33153 | NTIS, PC A07/MF A01. Order Number DE81030223, Distribution Category STD -64 |
| 10769 | 6:33766 | NTIS, PC A02/MF A01. Order Number DE81029846, Distribution Category MN -11 |
| 11387 | 6:33172 | NTIS, PC A02/MF A01. Order Number DE81029883, Distribution Category MN -59c |
| 11566 | 6:33038 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33047 | NTIS, PC A07/MF A01. Order Number DE81029947, Distribution Category STD -70 |
| 11566 | 6:33048 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33049 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33050 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33051 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33052 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33053 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33054 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33210 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33211 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33212 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33213 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33922 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33928 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33929 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11566 | 6:33930 | NTIS, PC A07/MF A01. Order Number DE81029947 |
| 11883 | 6:33548 | NTIS, PC A08/MF A01. Order Number DE81030351, Distribution Category MN -25 |
| 11985 | 6:33450 | NTIS, PC A05/MF A01. Order Number DE81028050, Distribution Category MN -95d |
| 11985 | 6:33451 | NTIS, PC A05/MF A01. Order Number DE81028050 |
| 11985 | 6:33452 | NTIS, PC A05/MF A01. Order Number DE81028050 |
| 11985 | 6:33453 | NTIS, PC A05/MF A01. Order Number DE81028050 |
| 11985 | 6:33454 | NTIS, PC A05/MF A01. Order Number DE81028050 |
| 11985 | 6:33455 | NTIS, PC A05/MF A01. Order Number DE81028050 |
| 11985 | 6:33456 | NTIS, PC A05/MF A01. Order Number DE81028050 |
| 11986 | 6:33579 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33580 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33746 | NTIS, PC A04/MF A01. Order Number DE81028051, Distribution Category MN -11 |
| 11986 | 6:33747 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33748 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33749 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33750 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33751 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33752 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33753 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33754 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33755 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33756 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33757 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33822 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33854 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 11986 | 6:33911 | NTIS, PC A04/MF A01. Order Number DE81028051 |
| 12000 | 6:32839 | NTIS, PC A24/MF A01. Order Number DE81027828 |
| 12000 | 6:32862 | NTIS, PC A24/MF A01. Order Number DE81027828 |
| 12000 | 6:33378 | NTIS, PC A24/MF A01. Order Number DE81027828 |
| 12000 | 6:33379 | NTIS, PC A24/MF A01. Order Number DE81027828 |
| 12000 | 6:33496 | NTIS, PC A24/MF A01. Order Number DE81027828, Distribution Category STD -13 |
| 12000 | 6:33526 | NTIS, PC A24/MF A01. Order Number DE81027828 |
| 12000 | 6:33527 | NTIS, PC A24/MF A01. Order Number DE81027828 |
| 12000 | 6:33569 | NTIS, PC A24/MF A01. Order Number DE81027828 |
| 12000 | 6:33589 | NTIS, PC A24/MF A01. Order Number DE81027828 |
| 12000 | 6:33612 | NTIS, PC A24/MF A01. Order Number DE81027828 |
| 12000 | 6:33620 | NTIS, PC A24/MF A01. Order Number DE81027828 |
| 12000 | 6:33699 | NTIS, PC A24/MF A01. Order Number DE81027828 |
| 12000 | 6:34045 | NTIS, PC A24/MF A01. Order Number DE81027828 |
| 12048 | 6:33173 | NTIS, PC A02/MF A01. Order Number DE81029882, Distribution Category MN -59c |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 12259 | 6:33457 | NTIS, PC A02/MF A01. Order Number DE81031927, Distribution Category MN -95d |
| 12370 | 6:34193 | NTIS, PC A03/MF A01. Order Number DE81029847, Distribution Category MN -32 |
| 12441 | 6:33621 | NTIS, PC A14/MF A01. Order Number DE81030350, Distribution Category MN -4 |
| 12777 | 6:33458 | NTIS, PC A03/MF A01. Order Number DE81030886, Distribution Category STD -95d |
| 12783 | 6:33637 | NTIS, PC A02/MF A01. Order Number DE81029855, Distribution Category MN -38 |
| 12887 | 6:33758 | NTIS, PC A02/MF A01. Order Number DE81029857, Distribution Category MN -11 |
| 12950 | 6:33969 | NTIS, PC A04/MF A01. Order Number DE81028129, Distribution Category MN -34 |
| 12972 | 6:33974 | NTIS, PC A02/MF A01. Order Number DE81028039, Distribution Category MN -34D |
| 12977 | 6:33154 | NTIS, PC A02/MF A01. Order Number DE81028876, Distribution Category MN -64 |
| 12979 | 6:33846 | NTIS, PC A05/MF A01. Order Number DE81029948, Distribution Category STD -48 |
| 12986 | 6:33590 | NTIS, PC A02/MF A01. Order Number DE81028135, Distribution Category MN -4 |
| 12987 | 6:33931 | NTIS, PC A04/MF A01. Order Number DE81030232, Distribution Category MN -70 |
| 12995 | 6:34180 | NTIS, PC A03/MF A01. Order Number DE81028134, Distribution Category MN -20a |
| 13054-Rev. | 6:33174 | NTIS, PC A02/MF A01. Order Number DE81028041, Distribution Category MN -59 |
| 13063 | 6:32878 | NTIS, PC A03/MF A01. Order Number DE81029853, Distribution Category MN -90d |
| 13178 | 6:33626 | NTIS, PC A03/MF A01. Order Number DE81030663, Distribution Category STD -92b |
| 13192 | 6:33830 | NTIS, PC A02/MF A01. Order Number DE81030410, Distribution Category MN -64 |
| 13193 | 6:33831 | NTIS, PC A02/MF A01. Order Number DE81030411, Distribution Category MN -64 |
| **LF-** | | |
| 2009 | 6:33493 | Aukland, New Zealand; New Zealand Energy Research and Development Committee (1981). |
| **LMF-** | | |
| 85 | 6:32960 | NTIS, PC A04/MF A01. Order Number DE81031000, Distribution Category STD -48 |
| **MASEC-CF-** | | |
| 81-019 | 6:33175 | NTIS, PC A02/MF A01. Order Number DE81030055, Distribution Category MN -58c |
| 81-023 | 6:33176 | NTIS, PC A02/MF A01. Order Number DE81030053, Distribution Category MN -58c |
| 81-035 | 6:33177 | NTIS, PC A02/MF A01. Order Number DE81030353, Distribution Category MN -59c |
| **MASEC-PA-** | | |
| 80-007 | 6:33178 | NTIS, PC A02/MF A01. Order Number DE81028344, Distribution Category MN -59a |
| **MASEC/R-** | | |
| 81-005 | 6:33114 | NTIS, PC A03/MF A01. Order Number DE81030356, Distribution Category MN -61 |
| 81-045 | 6:33179 | NTIS, PC A02/MF A01. Order Number DE81030056, Distribution Category MN -59b |
| 81-059/ 1 | 6:33180 | NTIS, PC A02/MF A01. Order Number DE81027968, Distribution Category MN -59 |
| **MHSMP-** | | |
| 81-37 | 6:33711 | NTIS, PC A02/MF A01. Order Number DE81030482, Distribution Category MN -45 |
| 81-38 | 6:33712 | NTIS, PC A03/MF A01. Order Number DE81030481, Distribution Category MN -45 |
| **MIT-EL-** | | |
| 79-016 | 6:33126 | NTIS, PC A03/MF A01. Order Number DE81029734, Distribution Category MN -63 |
| 79-026 | 6:33127 | NTIS, PC A09/MF A01. Distribution Category MN -63 |
| 79-029 | 6:33099 | NTIS, PC A04/MF A01. Order Number DE81029697, Distribution Category MN -63 |
| 79-030 | 6:33100 | NTIS, PC A06/MF A01. Order Number DE81029651, Distribution Category MN -63 |
| 79-032-Vol.1 | 6:33094 | NTIS, PC A10/MF A01. Order Number DE81029645, Distribution Category MN -63 |
| 79-033-Vol.2 | 6:33095 | NTIS, PC A08/MF A01. Order Number DE81029646, Distribution Category MN -63 |
| 79-041 | 6:33155 | NTIS, PC A06/MF A01. Order Number DE81029648, Distribution Category MN -64 |
| 79-042 | 6:33128 | NTIS, PC A03/MF A01. Order Number DE81029721, Distribution Category MN -63 |
| 79-044 | 6:33101 | NTIS, PC A03/MF A01. Order Number DE81029644, Distribution Category MN -63 |
| 79-045 | 6:33181 | NTIS, PC A03/MF A01. Order Number DE81029608, Distribution Category MN -63 |
| 80-002 | 6:33129 | NTIS, PC A05/MF A01. Order Number DE81029696, Distribution Category MN -63 |
| 80-007 | 6:33102 | NTIS, PC A03/MF A01. Order Number DE81029695, Distribution Category MN -63 |
| 80-008 | 6:33130 | NTIS, PC A02/MF A01. Order Number DE81029735, Distribution Category MN -63d |
| 80-024 | 6:33182 | NTIS, PC A03/MF A01. Order Number DE81029703, Distribution Category MN -59 |
| 80-025 | 6:33131 | NTIS, PC A03/MF A01. Order Number DE81029698, Distribution Category MN -63 |
| 80-028 | 6:33097 | NTIS, PC A04/MF A01. Order Number DE81029700, Distribution Category MN -63 |
| 80-033 | 6:33271 | NTIS, PC A12/MF A01. Order Number DE81030519, Distribution Category MN -97 |
| 81-004 | 6:33132 | NTIS, PC A05/MF A01. Order Number DE81029712, Distribution Category MN -32 |
| 81-012 | 6:33098 | NTIS, PC A08/MF A01. Order Number DE81029711, Distribution Category MN -63 |
| **MLM-** | | |
| 2850 | 6:33549 | NTIS, PC A05/MF A01. Order Number DE81030423, Distribution Category STD -25 |
| **NASA-CP-** | | |
| 2141 | 6:33133 | NTIS PC A16/MF A01 |
| **NASA-CR-** | | |
| 163882 | 6:33143 | NTIS PC A06/MF A01 |
| 163884 | 6:33144 | NTIS PC A08/MF A01 |
| 163889 | 6:33145 | NTIS PC A08/MF A01 |
| 165191 | 6:33439 | *See* DOE/NASA/0161-7 |
| 165235 | 6:33435 | *See* DOE/NASA/0051-2 |
| 165385 | 6:33241 | *See* DOE/NASA/3303-1 |
| **NASA-TM-** | | |
| 81622 | 6:33134 | NTIS PC A02/MF A01 |
| 81660 | 6:33487 | *See* DOE/NASA/51040-22 |
| 81670 | 6:33616 | NTIS PC A2/MF A01 |
| 81678 | 6:33509 | *See* DOE/NASA/2593-22 |
| 82646 | 6:33490 | *See* DOE/NASA/51040-31 |
| 82670 | 6:33438 | *See* DOE/NASA/1062-9 |
| 82682 | 6:33486 | *See* DOE/NASA/1011-34 |
| 82702 | 6:33441 | *See* DOE/NASA/12726-13 |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| **NEAC-** | | |
| 12 | 6:33494 | Canberra, Australia; Australian Government Publishing Service (1980). |
| **NESEC-** | | |
| 9 | 6:33183 | NTIS, PC A05/MF A01. Order Number DE81030052, Distribution Category MN -58b |
| **NP-** | | |
| 1903616 | 6:33104 | Berkeley, CA; University of California (1980). |
| 1903618 | 6:33463 | Queenstown, MD; Aspen Institute for Humanistic Studies (1980). |
| 1903712 | 6:33103 | $4.00 |
| 1903906 | 6:33233 | New Mexico Energy and Minerals Dept., Santa Fe |
| 1903916 | 6:33090 | NTIS, PC A03/MF A01. Distribution Category MN -59 |
| 1903997 | 6:33184 | NTIS (US Sales Only), PC A04/MF A01. Distribution Category MN -59 |
| 1904042 | 6:33497 | Cambridge, MA; Massachusetts Institute of Technology (1981). |
| **NSF-C-** | | |
| 310 | 6:33664 | *See* AD-A-092605 |
| **NTISUB/C-** | | |
| 221-404 | 6:33381 | NTIS. Order Number DE81029832, Distribution Category ND -13 |
| **NZERDC-** | | |
| 61 | 6:33493 | Aukland, New Zealand; New Zealand Energy Research and Development Committee (1981). |
| **ONWI-** | | |
| 9-81-2 | 6:33039 | NTIS, PC A12/MF A01. Order Number DE81030389, Distribution Category MN -70 |
| **ORNL-** | | |
| 5692 | 6:33889 | NTIS, PC A04/MF A01. Order Number DE81030434, Distribution Category STD -11 |
| 5721 | 6:33912 | NTIS, PC A10/MF A01. Order Number DE81027859, Distribution Category STD -48 |
| **ORNL/CON-** | | |
| 59 | 6:33459 | NTIS, PC A08/MF A01. Order Number DE81030630, Distribution Category MN -95d |
| **ORNL/CSD-** | | |
| 79 | 6:34194 | NTIS, PC A06/MF A01. Order Number DE81030466, Distribution Category STD -32 |
| **ORNL/CSD/TM-** | | |
| 126 | 6:33312 | NTIS, PC A03/MF A01. Order Number DE81030371, Distribution Category STD -79p |
| 155-Vol.1 | 6:32999 | NTIS, PC A07/MF A01. Order Number DE81030700, Distribution Category MN -32 |
| 157 | 6:34063 | NTIS, PC A03/MF A01. Order Number DE81030259, Distribution Category MN -20g |
| **ORNL/Sub-** | | |
| 80/ 40416/ 1 | 6:33392 | NTIS, PC A04/MF A01. Order Number DE81030497, Distribution Category MN -78 |
| 7399/ 1 | 6:33264 | NTIS, PC A15/MF A01. Order Number DE81030433, Distribution Category STD -97b |
| **ORNL/TM-** | | |
| 7001 | 6:34064 | NTIS, PC A04/MF A01. Order Number DE81030428, Distribution Category STD -20f |
| 7295 | 6:34019 | NTIS, PC A03/MF A01. Order Number DE81030704, Distribution Category MN -34C |
| 7438-Vol.2 | 6:33156 | NTIS, PC A04/MF A01. Order Number DE81030469, Distribution Category STD -64 |
| 7664 | 6:32841 | NTIS, PC A03/MF A01. Order Number DE81030425, Distribution Category STD -90d |
| 7724 | 6:32948 | NTIS, PC A05/MF A01. Order Number DE81030629, Distribution Category MN -90b |
| 7744 | 6:33722 | NTIS, PC A05/MF A01. Order Number DE81030431 |
| 7744 | 6:33723 | NTIS, PC A05/MF A01. Order Number DE81030431 |
| 7744 | 6:33759 | NTIS, PC A05/MF A01. Order Number DE81030431 |
| 7744 | 6:33769 | NTIS, PC A05/MF A01. Order Number DE81030431, Distribution Category STD -12 |
| 7757 | 6:33479 | NTIS, PC A08/MF A01. Order Number DE81030373, Distribution Category STD -95d |
| 7847 | 6:33265 | NTIS, PC A12/MF A01. Order Number DE81030262, Distribution Category MN -90e |
| 7852 | 6:33471 | NTIS, PC A04/MF A01. Order Number DE81030705, Distribution Category MN -95d |
| 7857 | 6:34065 | NTIS, PC A02/MF A01. Order Number DE81030427, Distribution Category STD -20a |
| 7858 | 6:33803 | NTIS, PC A03/MF A01. Order Number DE81030625, Distribution Category STD -41 |
| 7863 | 6:33427 | NTIS, PC A08/MF A01. Order Number DE81030696, Distribution Category MN -98E |
| 7879 | 6:34181 | NTIS, PC A05/MF A01. Order Number DE81030426, Distribution Category STD -20g |
| 7883 | 6:34028 | NTIS, PC A03/MF A01. Order Number DE81030436, Distribution Category STD -79d |
| 7886 | 6:33672 | NTIS, PC A03/MF A01. Order Number DE81030703, Distribution Category MN -28 |
| 7960 | 6:32803 | NTIS, PC A06/MF A01. Order Number DE81030229, Distribution Category MN -90 |
| 7970 | 6:33529 | NTIS, PC A12/MF A01. Order Number DE81030697, Distribution Category MN -25 |
| 7980 | 6:33361 | NTIS, PC A03/MF A01. Order Number DE81030701, Distribution Category MN -41 |
| **ORNL-tr-** | | |
| 4766 | 6:33551 | NTIS, PC A02/MF A01. Order Number DE81027615, Distribution Category MN -25 |
| 4777 | 6:33020 | NTIS, PC A03/MF A01. Order Number DE81029764, Distribution Category MN -70 |
| **ORO-** | | |
| 3728-14 | 6:33887 | *See* DOE/EV/03728-T1 |
| **P-** | | |
| 101-7 | 6:33175 | *See* MASEC-CF-81-019 |
| 101-12/ A-101-4 | 6:33176 | *See* MASEC-CF-81-023 |
| 103-4 | 6:33177 | *See* MASEC-CF-81-035 |
| 107-1 | 6:33179 | *See* MASEC/R-81-045 |
| **PATENTS-US-** | | (US: Commissioner of Patents, Washington, D.C. 20231, USA, $.50 per copy. Government Patent Applications available from NTIS) |
| A 188,791 | 6:33567 | |
| A 195,968 | 6:33707 | |
| A 198,028 | 6:33652 | |
| A 201,959 | 6:33651 | |
| A 202,042 | 6:33694 | |
| A 202,083 | 6:33566 | |
| 3,707,128 | 6:33481 | |
| 4,252,607 | 6:34191 | |
| 4,252,608 | 6:34190 | |
| 4,252,609 | 6:34192 | |
| 4,253,023 | 6:33692 | |
| 4,253,025 | 6:33693 | |
| 4,253,065 | 6:33656 | |
| 4,253,872 | 6:33536 | |
| 4,254,088 | 6:32868 | |
| 4,254,332 | 6:33650 | |
| 4,255,021 | 6:33705 | |
| 4,255,793 | 6:33659 | |
| **PNL-** | | |
| 3616 | 6:33804 | NTIS, PC A03/MF A01. Order Number DE81029397, Distribution Category MN -70 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 3645 | 6:33374 | NTIS, PC A14/MF A01. Order Number DE81030470, Distribution Category STD -94e |
| 3769 | 6:33375 | NTIS, PC A10/MF A01. Order Number DE81029943, Distribution Category STD -94e |
| 3791 | 6:33056 | NTIS, PC A10/MF A01. Order Number DE81029275, Distribution Category MN -70 |
| 3799 | 6:33382 | NTIS, PC A05/MF A01. Order Number DE81030676, Distribution Category MN -70 |
| 3801 | 6:33220 | NTIS, PC A06/MF A01. Order Number DE81030151, Distribution Category MN -66d |
| 3839 | 6:33068 | NTIS, PC A04/MF A01. Order Number DE81030185, Distribution Category MN -23 |
| 3853 | 6:33135 | NTIS, PC A04/MF A01. Order Number DE81030186, Distribution Category MN -63 |
| 3902 | 6:33040 | NTIS, PC A03/MF A01. Order Number DE81028403, Distribution Category MN -70 |
| 3948 | 6:33041 | NTIS, PC A04/MF A01. Order Number DE81030621, Distribution Category MN -70 |
| **PNL-SA-** | | |
| 8432 | 6:33760 | NTIS, PC A02/MF A01. Order Number DE81030084, Distribution Category MN -11 |
| 9049 | 6:33460 | NTIS, PC A03/MF A01. Order Number DE81030075, Distribution Category MN -95d |
| 9140 | 6:33767 | NTIS, PC A02/MF A01. Order Number DE81030093, Distribution Category MN -11 |
| 9143 | 6:33581 | NTIS, PC A02/MF A01. Order Number DE81030009, Distribution Category MN -4 |
| 9149 | 6:33234 | NTIS, PC A02/MF A01. Order Number DE81030077, Distribution Category MN -60 |
| 9246 | 6:33115 | NTIS, PC A02/MF A01. Order Number DE81030085, Distribution Category MN -61a |
| 9262 | 6:33057 | NTIS, PC A03/MF A01. Order Number DE81030083, Distribution Category MN -11 |
| 9266 | 6:33530 | NTIS, PC A02/MF A01. Order Number DE81030078, Distribution Category MN -20c |
| 9315 | 6:33890 | NTIS, PC A03/MF A01. Order Number DE81030090, Distribution Category MN -48 |
| 9316 | 6:33362 | NTIS, PC A02/MF A01. Order Number DE81030106, Distribution Category MN -80 |
| 9317 | 6:34042 | NTIS, PC A02/MF A01. Order Number DE81030102, Distribution Category MN -41 |
| 9377 | 6:33591 | NTIS, PC A02/MF A01. Order Number DE81030079, Distribution Category MN -4 |
| 9411 | 6:33243 | NTIS, PC A02/MF A01. Order Number DE81030100, Distribution Category MN -60 |
| 9419 | 6:33835 | NTIS, PC A02/MF A01. Order Number DE81028342, Distribution Category MN -11 |
| 9435 | 6:33913 | NTIS, PC A02/MF A01. Order Number DE81030069, Distribution Category MN -41 |
| 9446 | 6:33531 | NTIS, PC A02/MF A01. Order Number DE81030076, Distribution Category MN -25 |
| 9478 | 6:33923 | NTIS, PC A03/MF A01. Order Number DE81030088, Distribution Category MN -11 |
| 9606 | 6:33761 | NTIS, PC A02/MF A01. Order Number DE81030096, Distribution Category MN -58b |
| 9632 | 6:33891 | NTIS, PC A02/MF A01. Order Number DE81028440, Distribution Category MN -41 |
| 9635 | 6:33638 | NTIS, PC A02/MF A01. Order Number DE81030082, Distribution Category MN -70 |
| 9641 | 6:33297 | NTIS, PC A02/MF A01. Order Number DE81030089, Distribution Category MN -78 |
| 9712 | 6:33963 | NTIS, PC A02/MF A01. Order Number DE81030081, Distribution Category MN -38 |
| 9728 | 6:33532 | NTIS, PC A02/MF A01. Order Number DE81030080, Distribution Category MN -20c |
| 9751 | 6:33116 | NTIS, PC A02/MF A01. Order Number DE81030097, Distribution Category MN -63 |
| 9782 | 6:33370 | NTIS, PC A02/MF A01. Order Number DE81030099, Distribution Category MN -94e |
| 9792 | 6:32997 | NTIS, PC A03/MF A01. Order Number DE81030105, Distribution Category MN -91 |
| **PPPL-** | | |
| 1814 | 6:34066 | NTIS, PC A02/MF A01. Order Number DE81030383, Distribution Category STD -20g |
| 1829 | 6:34067 | NTIS, PC A02/MF A01. Order Number DE81030384, Distribution Category STD -20a |
| 1830 | 6:34068 | NTIS, PC A03/MF A01. Order Number DE81030385, Distribution Category STD -20g |
| 1831 | 6:34069 | NTIS, PC A03/MF A01. Order Number DE81030382, Distribution Category STD -20g |
| 1832 | 6:34182 | NTIS, PC A02/MF A01. Order Number DE81030386, Distribution Category STD -20a |
| **R/M/N-** | | |
| 1068 | 6:33325 | NTIS (US Sales Only), PC A02/MF A01. Order Number DE81903976, Distribution Category STD -79h |
| **R/M/R-** | | |
| 207 | 6:33326 | NTIS (US Sales Only), PC A02/MF A01. Order Number DE81903974, Distribution Category STD -79h |
| 263 | 6:33327 | NTIS (US Sales Only), PC A03/MF A01. Order Number DE81903972, Distribution Category STD -79h |
| 271 | 6:33328 | NTIS (US Sales Only), PC A03/MF A01. Order Number DE81903975, Distribution Category STD -79h |
| **RD/M/N-** | | |
| 1131 | 6:33266 | NTIS (US Sales Only), PC A02/MF A01. Order Number DE81903971, Distribution Category STD -79h |
| **RFP-** | | |
| 2462-Add. | 6:33768 | NTIS, PC A02/MF A01. Order Number DE81028516, Distribution Category STD -13 |
| 3180 | 6:33622 | NTIS, PC A04/MF A01. Order Number DE81030182, Distribution Category STD -4 |
| 3208 | 6:33655 | NTIS, PC A03/MF A01. Order Number DE81028933, Distribution Category MN -38 |
| **SAI-** | | |
| 254-81-262-LJ | 6:34070 | NTIS, PC A02/MF A01. Order Number DE81030224, Distribution Category STD -20g |
| **SAN-** | | |
| 821-2 | 6:33918 | *See* DOE/ID/01375-T1 |
| 2191-1 | 6:33163 | *See* DOE/CS/32197-T1 |
| **SAND-** | | |
| 80-0451 | 6:33657 | NTIS, PC A03/MF A01. Order Number DE81030999, Distribution Category MN -38 |
| 80-0933 | 6:33230 | NTIS, PC A03/MF A01. Order Number DE81030998, Distribution Category STD -66c |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 80-2365 | 6:33338 | NTIS, PC A04/MF A01. Order Number DE81026470, Distribution Category MN -80 |
| 80-2689 | 6:33700 | NTIS, PC A02/MF A01. Order Number DE81031922, Distribution Category MN -37 |
| 81-0043 | 6:32971 | NTIS, PC A06/MF A01. Order Number DE81029457, Distribution Category MN -92a |
| 81-0064C | 6:33550 | NTIS, PC A02/MF A01. Order Number DE81030209, Distribution Category MN -25 |
| 81-0208C | 6:33639 | NTIS, PC A02/MF A01. Order Number DE81012161, Distribution Category MN -38 |
| 81-0275-Rev. | 6:33146 | NTIS, PC A02/MF A01. Order Number DE81031926, Distribution Category MN -63 |
| 81-0369 | 6:33195 | NTIS, PC A04/MF A01. Order Number DE81029994, Distribution Category STD -62 |
| 81-0373 | 6:33185 | NTIS, PC A03/MF A01. Order Number DE81029136, Distribution Category MN -62 |
| 81-0632 | 6:33920 | NTIS, PC A03/MF A01. Order Number DE81029315, Distribution Category MN -41 |
| 81-0645 | 6:33921 | NTIS, PC A04/MF A01. Order Number DE81031931, Distribution Category MN -41 |
| 81-0754C | 6:33658 | NTIS, PC A02/MF A01. Order Number DE81026290, Distribution Category MN -28 |
| 81-0786 | 6:33560 | NTIS, PC A04/MF A01. Order Number DE81031919, Distribution Category MN -25 |
| 81-0786C | 6:33552 | NTIS, PC A02/MF A01. Order Number DE81023177, Distribution Category MN -25 |
| 81-0937 | 6:33713 | NTIS, PC A03/MF A01. Order Number DE81030979, Distribution Category MN -45 |
| 81-1007C | 6:34195 | NTIS, PC A02/MF A01. Order Number DE81025838, Distribution Category MN -13 |
| 81-1051 | 6:33062 | NTIS, PC A02/MF A01. Order Number DE81031938, Distribution Category MN -15 |
| 81-1128 | 6:32993 | NTIS, PC A03/MF A01. Order Number DE81030987, Distribution Category MN -91 |
| 81-1135C | 6:33964 | NTIS, PC A02/MF A01. Order Number DE81026973, Distribution Category MN -34 |
| 81-1151C | 6:34046 | NTIS, PC A02/MF A01. Order Number DE81030206, Distribution Category MN -34 |
| 81-1271 | 6:33932 | NTIS, PC A03/MF A01. Order Number DE81030985, Distribution Category MN -11 |
| 81-1337 | 6:33959 | NTIS, PC A04/MF A01. Order Number DE81030984, Distribution Category MN -34A |
| 81-1358C | 6:33533 | NTIS, PC A02/MF A01. Order Number DE81026109, Distribution Category MN -25 |
| 81-1472 | 6:34183 | NTIS, PC A03/MF A01. Order Number DE81028972, Distribution Category MN -34 |
| 81-1782 | 6:33701 | NTIS, PC A02/MF A01. Order Number DE81030988, Distribution Category MN -13 |
| 81-1814C | 6:33491 | NTIS, PC A02/MF A01. Order Number DE81026462, Distribution Category MN -96 |
| 81-1834C | 6:33561 | NTIS, PC A02/MF A01. Order Number DE81028386, Distribution Category MN -25 |
| 81-1864C | 6:34184 | NTIS, PC A02/MF A01. Order Number DE81028389, Distribution Category MN -21 |
| 81-7014/ Vol.1-2 | 6:33136 | NTIS, PC A12/MF A01. Order Number DE81030982, Distribution Category MN -63 |
| 81-7014/ Vol.3 | 6:33137 | NTIS, PC A10/MF A01. Order Number DE81030986, Distribution Category MN -63 |
| 81-7014/ Vol.4 | 6:33138 | NTIS, PC A05/MF A01. Order Number DE81031921, Distribution Category MN -63 |
| 81-7014/ Vol.5 | 6:33139 | NTIS, PC A07/MF A01. Order Number DE81030981, Distribution Category MN -63 |
| 81-8177-Exec.Summ. | 6:33196 | NTIS, PC A02/MF A01. Order Number DE81029752, Distribution Category MN -62d |
| 81-8177-Vol.1 | 6:33197 | NTIS, PC A19/MF A01. Order Number DE81029618, Distribution Category MN -62d |
| 81-8177-Vol.2 | 6:33198 | NTIS, PC A09/MF A01. Order Number DE81029824, Distribution Category MN -62d |
| 81-8184 | 6:33201 | NTIS, PC A14/MF A01. Order Number DE81029622, Distribution Category MN -62d |
| 81-8236 | 6:33147 | NTIS, PC A04/MF A01. Order Number DE81029623, Distribution Category MN -62 |
| **SERI/PR-** | | |
| 0-9010-2 | 6:33117 | NTIS, PC A02/MF A01. Order Number DE81027234, Distribution Category MN -63 |
| 0-9010-3 | 6:33118 | NTIS, PC A02/MF A01. Order Number DE81027254, Distribution Category MN -63 |
| 9296-T1 | 6:33119 | NTIS, PC A03/MF A01. Order Number DE81026219, Distribution Category STD -63 |
| **SERI/RR-** | | |
| 641-615 | 6:33199 | NTIS, PC A04/MF A01. Order Number DE81030832, Distribution Category MN -59c |
| **SERI/TP-** | | |
| 233-1388 | 6:33120 | NTIS, PC A02/MF A01. Order Number DE81030312, Distribution Category MN -61c |
| 351-508 | 6:33091 | NTIS, PC A02/MF A01. Order Number DE81028006, Distribution Category MN -58 |
| 620-1344 | 6:33202 | NTIS, PC A02/MF A01. Order Number DE81029476, Distribution Category MN -62 |
| 622-1174 | 6:33121 | NTIS, PC A02/MF A01. Order Number DE81030507, Distribution Category MN -61a |
| 631-1163 | 6:33203 | NTIS, PC A02/MF A01. Distribution Category STD -59c |
| 634-1282 | 6:33157 | NTIS, PC A02/MF A01. Order Number DE81029277, Distribution Category MN -64 |
| 642-1343 | 6:33096 | NTIS, PC A02/MF A01. Order Number DE81029067, Distribution Category MN -59c |
| **SERI/TR-** | | |
| 332-416-Vol.2 | 6:33442 | NTIS, PC A10/MF A01. Order Number DE81029624, Distribution Category MN -61 |
| 98288-1 | 6:33186 | NTIS, PC A06/MF A01. Order Number DE81030309, Distribution Category MN -59c |
| **SLAC-PUB-** | | |
| 2642 | 6:33690 | NTIS, PC A03/MF A01. Order Number DE81028097, Distribution Category MN -37 |
| 2761 | 6:33970 | NTIS, PC A05/MF A01. Order Number DE81028229, Distribution Category MN -34D |
| 2776 | 6:33989 | NTIS, PC A03/MF A01. Order Number DE81030644, Distribution Category MN -34D |
| **SLAC-TN-** | | |
| 81-5 | 6:33673 | NTIS, PC A04/MF A01. Order Number DE81030177, Distribution Category MN -28 |
| 81-6 | 6:33691 | NTIS, PC A03/MF A01. Order Number DE81030176, Distribution Category MN -28 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **SOLAR/0020-** | | |
| 81/ 44 | 6:33092 | NTIS, PC A04/MF A01. Order Number DE81026211, Distribution Category STD -59 |
| **SOLAR/1041-** | | |
| 81/ 14 | 6:33187 | NTIS, PC A05/MF A01. Order Number DE81028174, Distribution Category STD -59 |
| **SOLAR/1045-** | | |
| 80/ 14 | 6:33188 | NTIS, PC A05/MF A01. Order Number DE81028175, Distribution Category STD -59 |
| **SOLAR/1060-** | | |
| 81/ 14 | 6:33189 | NTIS, PC A05/MF A01. Order Number DE81029986, Distribution Category STD -59 |
| **SOLAR/2008-** | | |
| 81/ 14 | 6:33190 | NTIS, PC A06/MF A01. Order Number DE81029985, Distribution Category STD -59 |
| **TAC/H-** | | |
| 81-001 | 6:33075 | Univ. of New Mexico, Albuquerque. Distribution Category MN -94d |
| **TAC/SP-** | | |
| 81-002 | 6:33122 | Univ. of New Mexico, Albuquerque. Distribution Category MN -63 |
| **TAC-STPG-** | | |
| 81-001 | 6:33093 | Univ. of New Mexico, Albuquerque. Distribution Category MN -62 |
| **TES-** | | |
| 32075-107 | 6:33562 | NTIS, PC A03/MF A01. Order Number DE81027823, Distribution Category MN -25 |
| **TVA/OP/EDT-** | | |
| 81/ 39 | 6:33480 | NTIS, PC A05/MF A01. Order Number DE81903570, Distribution Category MN -95e |
| **UCID-** | | |
| 16986-81-2 | 6:32994 | NTIS, PC A02/MF A01. Order Number DE81030315, Distribution Category MN -91 |
| 19076 | 6:34196 | NTIS, PC A12/MF A01. Order Number DE81030675, Distribution Category MN -32 |
| 19104 | 6:33298 | NTIS, PC A02/MF A01. Order Number DE81030473, Distribution Category MN -78 |
| 19105 | 6:33299 | NTIS, PC A02/MF A01. Order Number DE81030472, Distribution Category MN -78 |
| 19164 | 6:33719 | NTIS, PC A02/MF A01. Order Number DE81030478, Distribution Category MN -38 |
| 19173 | 6:34071 | NTIS, PC A02/MF A01. Order Number DE81030313, Distribution Category MN -21 |
| 19176 | 6:34185 | NTIS, PC A02/MF A01. Order Number DE81030308, Distribution Category MN -21 |
| 19178 | 6:33380 | NTIS, PC A02/MF A01. Order Number DE81030479, Distribution Category MN -96 |
| 19185 | 6:33952 | NTIS, PC A03/MF A01. Order Number DE81030480, Distribution Category MN -34B |
| **UCRL-** | | |
| 15348 | 6:33649 | NTIS, PC A05/MF A01. Order Number DE81030013, Distribution Category MN -21 |
| 15373 | 6:33563 | NTIS, PC A02/MF A01. Order Number DE81030010, Distribution Category MN -25 |
| 15375 | 6:33564 | NTIS, PC A03/MF A01. Order Number DE81030065, Distribution Category MN -25 |
| 50026-81-1 | 6:32842 | NTIS, PC A03/MF A01. Order Number DE81030634, Distribution Category STD -90c |
| 52853-Pt.1 | 6:33828 | NTIS, PC A06/MF A01. Order Number DE81029429, Distribution Category MN -11 |
| 52903 | 6:33714 | NTIS, PC A03/MF A01. Order Number DE81030468, Distribution Category STD -35 |
| 52980 | 6:33221 | NTIS, PC A04/MF A01. Order Number DE81030637, Distribution Category MN -66 |
| 53103 | 6:33720 | NTIS, PC A06/MF A01. Order Number DE81030633, Distribution Category STD -11 |
| 53131 | 6:33383 | NTIS, PC A03/MF A01. Order Number DE81029430, Distribution Category STD -95c |
| 53152-Pt.1 | 6:33805 | NTIS, PC A04/MF A01. Order Number DE81030467, Distribution Category STD -2 |
| 53197 | 6:32998 | NTIS, PC A09/MF A01. Order Number DE81031929, Distribution Category MN -91 |
| 53853-Pt.3 | 6:33829 | NTIS, PC A03/MF A01. Order Number DE81030471, Distribution Category STD -11 |
| 85035 | 6:33762 | NTIS, PC A02/MF A01. Order Number DE81030073, Distribution Category MN -11 |
| 85156-Rev.1 | 6:34197 | NTIS, PC A02/MF A01. Order Number DE81030071, Distribution Category MN -38 |
| 85553 | 6:33055 | NTIS, PC A03/MF A01. Order Number DE81029638, Distribution Category MN -25 |
| 85564 | 6:33640 | NTIS, PC A02/MF A01. Order Number DE81028851, Distribution Category MN -25 |
| 85645 | 6:34186 | NTIS, PC A02/MF A01. Order Number DE81029914, Distribution Category MN -21 |
| 85749 | 6:34202 | NTIS, PC A03/MF A01. Order Number DE81028424, Distribution Category MN -32 |
| 85763-Rev.1 | 6:33702 | NTIS, PC A02/MF A01. Order Number DE81029610, Distribution Category MN -37 |
| 85877 | 6:33641 | NTIS, PC A02/MF A01. Order Number DE81029979, Distribution Category MN -13 |
| 86143 | 6:34203 | NTIS, PC A02/MF A01. Order Number DE81025978, Distribution Category MN -13 |
| 86148 | 6:33222 | NTIS, PC A02/MF A01. Order Number DE81027652, Distribution Category MN -66a |
| 86162 | 6:34072 | NTIS, PC A02/MF A01. Order Number DE81029866, Distribution Category MN -21 |
| 86163 | 6:34073 | NTIS, PC A02/MF A01. Order Number DE81029867, Distribution Category MN -21 |
| 86372 | 6:33715 | NTIS, PC A02/MF A01. Order Number DE81026776, Distribution Category MN -35 |
| 86515 | 6:33223 | NTIS, PC A02/MF A01. Order Number DE81027713, Distribution Category MN -66 |
| 86560 | 6:33492 | NTIS, PC A02/MF A01. Order Number DE81028446, Distribution Category MN -96 |
| 86563 | 6:33716 | NTIS, PC A02/MF A01. Order Number DE81028179, Distribution Category MN -45 |
| 86581 | 6:34198 | NTIS, PC A02/MF A01. Order Number DE81030159, Distribution Category MN -32 |
| 86600 | 6:33065 | NTIS, PC A02/MF A01. Order Number DE81029636, Distribution Category MN -20 |
| 86622 | 6:33076 | NTIS, PC A02/MF A01. Order Number DE81029606, Distribution Category MN -61d |
| 86623 | 6:33077 | NTIS, PC A02/MF A01. Order Number DE81029607, Distribution Category MN -4 |
| **WAPD-TM-** | | |
| 1473 | 6:33653 | NTIS, PC A06/MF A01. Order Number DE81031930, Distribution Category MN -32 |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| **Y-** | | |
| 2227 | 6:33642 | NTIS, PC A03/MF A01. Order Number DE81029950, Distribution Category STD -38 |
| **Y/DV-** | | |
| 134 | 6:33534 | NTIS, PC A02/MF A01. Order Number DE81030285, Distribution Category MN -25 |
| **Y/IA-** | | |
| 152 | 6:33643 | NTIS, PC A02/MF A01. Order Number DE81030645, Distribution Category MN -38 |

## Abbreviations Used in Availability Column

**Dep.** DOE reports so designated are maintained in the organizations listed on the inside back cover.

**EM** Inquiries regarding the availability of blueline prints of DOE engineering drawings which were formerly available for sale by NTIS should be addressed to Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

**ETEC** Available *only to requesters within the United States* from the Energy Technology Engineering Center, P. O. Box 1449, Canoga Park, California 91304.

**GJO** Available from DOE Grand Junction Office, P. O. Box 2567, Grand Junction, Colorado 81501.

**GPO** For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.

**NSO** Available *only to requesters within the United States* from the Nuclear Standards Office, Oak Ridge National Laboratory, P. O. Box X, Oak Ridge, Tennessee 37830.

**NTIS** For sale by the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161. Price given is the domestic price for paper copy; prices for foreign purchasers are in most instances twice the domestic price.

**TIC** Available from the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

## NTIS NORTH AMERICAN PRICE CODES

Most NTIS products and services are now announced by price codes and, therefore, without specific prices in NTIS journals, newsletters and indexes.

The current dollar equivalent for each code is shown in the schedule below. Orders must list the accession number(s) and be accompanied by the total dollar amount from the current schedule.

### NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, U.S., and Mexico please use this price schedule; other addressees write for Folder PR-360-4.

| | | |
|---|---|---|
| A01.....$3.50 | E01.....$5.50 | T01..... $110.00 |
| A02..... 5.00 | E02..... 6.50 | T02..... 125.00 |
| A03..... 6.50 | E03..... 8.50 | T03..... 210.00 |
| A04..... 8.00 | E04.....10.50 | T04..... 300.00 |
| A05..... 9.50 | E05.....12.50 | T05..... 360.00 |
| A06.....11.00 | E06.....14.50 | T06..... 420.00 |
| A07.....12.50 | E07.....16.50 | T07..... 480.00 |
| A08.....14.00 | E08.....18.50 | T08..... 540.00 |
| A09.....15.50 | E09.....20.50 | T09..... 600.00 |
| A10.....17.00 | E10.....22.50 | T10..... 660.00 |
| A11.....18.50 | E11.....24.50 | T11..... 720.00 |
| A12.....20.00 | E12.....27.50 | T12..... 780.00 |
| A13.....21.50 | E13.....30.50 | T13..... 840.00 |
| A14.....23.00 | E14.....33.50 | T14..... 900.00 |
| A15.....24.50 | E15.....36.50 | T15..... 960.00 |
| A16.....26.00 | E16.....39.50 | T16.....1,020.00 |
| A17.....27.50 | E17.....42.50 | T17.....1,080.00 |
| A18.....29.00 | E18.....45.50 | T18.....1,140.00 |
| A19.....30.50 | E19.....50.50 | T19.....1,200.00 |
| A20.....32.00 | E20.....60.50 | T99..... * |
| A21.....33.50 | E99..... * | |
| A22.....35.00 | N01.....30.00 | |
| A23.....36.50 | N02.....50.00 | |
| A24.....38.00 | | |
| A25.....39.50 | *Contact NTIS for price quote | |
| A99..... * | | |

PRICES EFFECTIVE JANUARY 1, 1981

**U.S. DEPARTMENT OF COMMERCE**
**National Technical Information Service**
5285 Port Royal Road
Springfield, Virginia 22161

☆U.S. GOVERNMENT PRINTING OFFICE: 1981—546-064:16

Cut out appropriate form and mail in a stamped envelope to the address indicated.

## *Change of Address Form*

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

**PLEASE PRINT OR TYPE**

(or) COUNTRY

Mail this form to:

NEW ADDRESS
Superintendent of Documents
Government Printing Office SSOM
Washington, D.C. 20402

Attach last subscription label here.

## *Subscription Order Form*

**SUBSCRIPTION ORDER FORM**

**ENTER MY SUBSCRIPTION TO:**

**@ $ Domestic; @ $ Foreign.**

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

**PLEASE PRINT OR TYPE**

(or) COUNTRY

☐ Remittance Enclosed (Make checks payable to Superintendent of Documents)

☐ Charge to my Deposit Account No. .....

MAIL ORDER FORM TO:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

# REPORT COLLECTIONS

The libraries listed below purchase and maintain microfiche collections of DOE and foreign reports. Most of these libraries have microfiche reader-printers or other photocopy facilities with which to reproduce enlarged copies from microfiche. Charges for reproduction services vary.

## United States

**ALABAMA**
Auburn, Auburn University
**ARIZONA**
Tucson, University of Arizona
**CALIFORNIA**
Davis, University of California
Los Angeles, University of California
Santa Barbara, University of California
**COLORADO**
Boulder, University of Colorado
**DISTRICT OF COLUMBIA**
Washington, Library of Congress
**FLORIDA**
Gainesville, University of Florida
**GEORGIA**
Atlanta, Georgia Institute of Technology
**HAWAII**
Honolulu, University of Hawaii
**IDAHO**
Pocatello, Idaho State University
**ILLINOIS**
Urbana, University of Illinois
**INDIANA**
Lafayette, Purdue University
**IOWA**
Ames, Iowa State University
**KANSAS**
Manhattan, Kansas State University
**KENTUCKY**
Lexington, University of Kentucky
**MARYLAND**
Baltimore, Johns Hopkins University
College Park, University of Maryland
**MASSACHUSETTS**
Cambridge, Massachusetts Institute of Technology
Worcester, Worcester Polytechnic Institute
**MICHIGAN**
Ann Arbor, University of Michigan
**MISSISSIPPI**
Mississippi State, Mississippi State University
**MISSOURI**
Columbia, University of Missouri
Kansas City, Linda Hall Library
**NEBRASKA**
Lincoln, University of Nebraska
**NEW JERSEY**
Princeton, Princeton University
**NEW MEXICO**
Albuquerque, University of New Mexico
**NEW YORK**
Albany, New York State Library
Albany, State University at Albany
Ithaca, Cornell University
New York, Columbia University
Rochester, University of Rochester
Syracuse, Syracuse University
**NORTH CAROLINA**
Raleigh, North Carolina State University
**OHIO**
Cincinnati, University of Cincinnati
Cleveland, Cleveland Public Library
Toledo, University of Toledo
**OKLAHOMA**
Norman, University of Oklahoma
**PENNSYLVANIA**
Pittsburgh, Carnegie Library
**PUERTO RICO**
San Juan, University of Puerto Rico
**SOUTH CAROLINA**
Columbia, University of South Carolina
**TEXAS**
Austin, University of Texas
College Station, Texas A & M University
Houston, Rice University
**UTAH**
Salt Lake City, University of Utah
**VIRGINIA**
Charlottesville, University of Virginia
**WASHINGTON**
Pullman, Washington State University
Seattle, University of Washington
**WEST VIRGINIA**
Morgantown, West Virginia University
**WISCONSIN**
Madison, University of Wisconsin

## International

**EUROPEAN ATOMIC ENERGY COMMUNITY (EURATOM)**
Brussels, Belgium
Ispra, Varese, Italy, Cetis Library
**INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA)**
Vienna, Austria
**OECD NUCLEAR ENERGY AGENCY (NEA)**
British Library Lending Division
Boston Spa, Wetherby, Yorkshire, England

## AVAILABILITY OF PUBLICATIONS ABSTRACTED

DOE reports are offered for sale by National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161. The availability of other reports, when known, is also indicated in the report number indexes. The availability of some unnumbered reports is given at the point of the citation.

For information on non-report documents such as journal articles, conference papers, books, and monographs the user should contact local, state, and university libraries or commercial reprint services.

Corporate Index
Author Index
Subject Index
Contract Number Index
Report Number Index

UNITED STATES DEPARTMENT OF ENERGY
P.O. BOX 62
OAK RIDGE, TENNESSEE 37830

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
UNITED STATES
DEPARTMENT OF ENERGY

FS- 1
UNIVERSITY MICROFILMS INTERNATIONAL
ATTN SERIALS PROCESSING
300 NORTH ZEEB ROAD
ANN ARBOR, MI 48106